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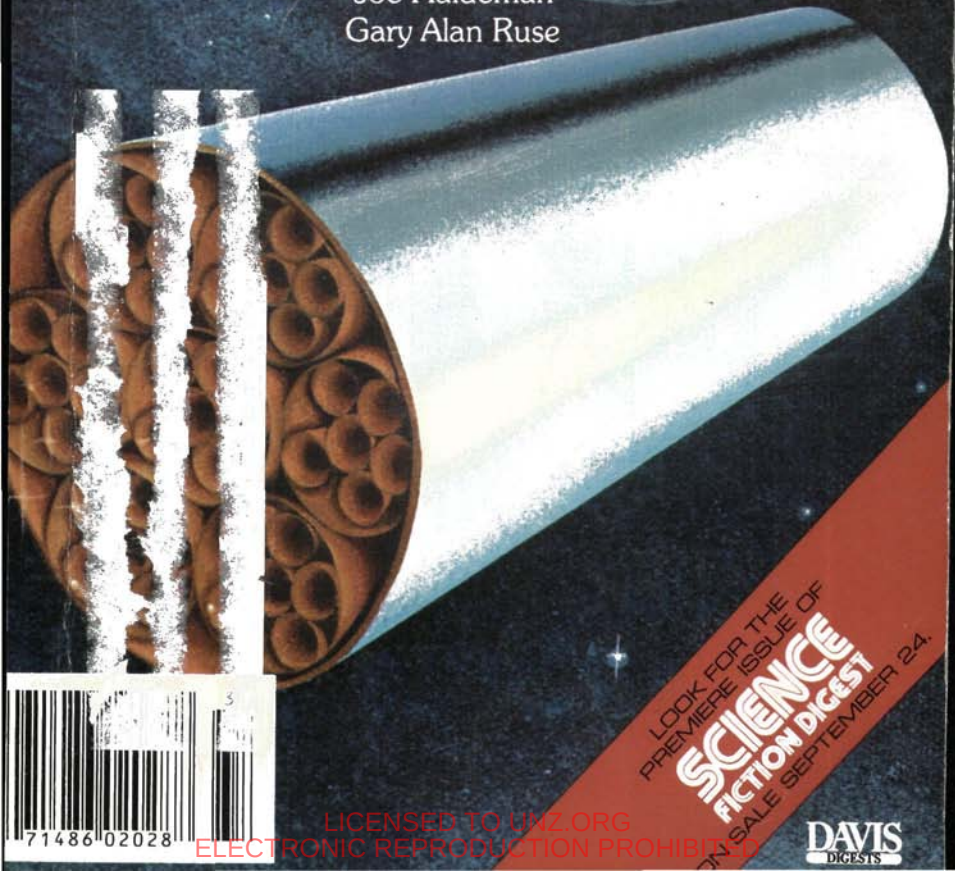

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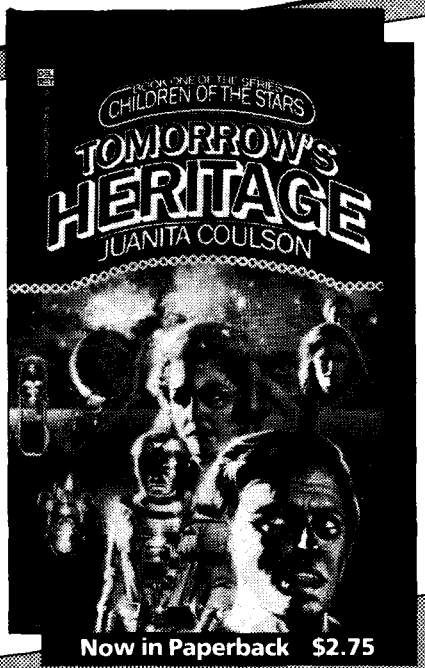

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Editorial

Stanley Schmidt

WHO PAYS THE PIPER?

One problem the arts and sciences have in common (along with the rest of us) is finances. At the very least, writers and painters and theoretical physicists must pay their rent and grocery bills and buy the basic tools of their trades. For the arts and sciences to flourish, of course, there must also be museums, concert halls, publishers, libraries, observatories, and laboratories. All those things cost a lot to build, equip, and maintain,

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and most of them find it difficult to generate enough direct revenue to support themselves. Commercial art and literature sometimes can, but are often accused of being more commercial than artistic or literary. Applied science can, by producing marketable inventions, but truly basic research seldom does because its applications haven't been thought of yet. Thus, while direct sale of the products of art and science has usually provided *some* of their support, a good deal of it has had to come from other sources.

The Pied Piper of Hamelin, in Robert Browning's poetic fable, was an artist. Evidently he was also a bit of a scientist, since he was able to apply his art to a reliable and versatile form of pest control. Unfortunately, the Pied Piper was a poor businessman: he settled for an oral agreement which his clients—who also happened to be the local judiciary—had no intention of keeping. Modern pipers tend to be wiser. They hold out for payment in advance, or at least an enforceable commitment to payment on delivery of an acceptable product. (Yes, this applies even to a magazine like *Analog*. We won't promise to buy a piece you haven't written yet, but you may be sure that if you write something I like, you'll be promptly paid our standard rates.)

The real question these days is: where will the money come from? Basically, there are two forms of support in common use. The individual scientist or artist is not always fully conscious of the difference; he just cashes a check. But ultimately that check almost certainly comes either from the sale of published copies, tickets to performances, or manufactured goods; or from a direct grant from a government or a private foundation.

Each method has both advantages and disadvantages, and their relative merits have probably been debated for as long as people have realized that there was more than one way. As I write this, that perennial controversy is perhaps a bit more heated than usual, at least in this country. We have a new federal administration whose actual strengths and weaknesses remain to be seen, but it has already shown a clear commitment to slashing federal expenditures in many areas—including withdrawing large quantities of support for "cultural" (i.e., artistic) and scientific endeavors. Quite predictably, people interested in science or art or both are quite upset. With federal money cut off, they ask, what will become of us?

Now for my Heresy of the Month: Could it be that the loss of federal subsidies could be to the ultimate *benefit* of science and art?

Not everybody will agree on what constitutes "benefit," of course, but I do know this. *Different kinds of payment buy different kinds of pipers.*

Proponents of one system or the other know this, and often use it in arguments. However, I'm not sure they always fairly represent the difference. The way I usually hear it in the case of the arts, for example, is something like this. When writers or composers must depend on publishers who get their money by selling a product, and place a high priority on selling enough to live comfortably, they are forced to turn out the

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same insipid stuff time after time, to please the crassly commercial entrepreneurs and the uncouth masses. They dare not experiment with fresh, new forms and themes. Art stagnates. Solution: eliminate the dependence on commercial appeal. Provide foundation grants to creative people, freeing them from worries about bills to create whatever they wish.

What I see, when I look for examples of these two approaches in practice, is disturbingly different. The foundation grant approach has been standard in "serious" music—symphonic and operatic—for quite some time. For roughly the same time, in my subjective but semiprofessional opinion, new serious music has, with few exceptions, been stuck in a blind alley, amusing itself and hardly anyone else. A symphony concert will often include a world premiere of a new piece—which in many cases will seldom, if ever, be heard again. That's fine with the audiences, because most of them have come to regard the usual world premiere as a very poor bet for delivering any listening pleasure. They have come to regard it as something they must stoically endure as part of the price of the "real" music they came and paid to hear. Critics may like it (or claim to), but it communicates little to most listeners.

'Twas not always thus, despite the popular myth (gratefully nurtured by *avant garde* composers) that great composers were never understood or appreciated in their own times. In a word, balderdash. Yes, there are examples like that. Gustav Mahler, for one, has become very popular with symphony audiences in the last couple of decades, but in his own time (broadly around the turn of the century) was much more highly regarded as a conductor than as a composer. But that's the exception, not the rule. There is a larger number of cases of specific premieres being roundly panned by critics and/or audiences, such as the riots (literally!) at the premiere of Stravinsky's *Rite of Spring*. But the real significance of these can be seen only in context. Most composers whose names are still well known had appreciable followings in their own lifetimes. The riots and such tended to occur when audiences went to hear a premiere by someone from whom they expected a lot—and got something very unlike their expectations. Even when composers had royal patrons, the patrons expected to be entertained, and might well withdraw their support if they were not.

Today's audiences, I submit, have abdicated their responsibility for good music. They *should* riot—or at the very least withhold applause—a lot oftener than they do. By stoically enduring work they don't like by composers whose foundation grants free them of all responsibility to audiences, they encourage the proliferation of pointless intellectual exercises and do nothing to stimulate the production of memorable new music that *does* communicate with people. They pay for their concert tickets; they should demand their money's worth, and keep a critical eye on any new clothes attributed to the emperor.

Now, is there any place in the arts where this kind of feedback between creator and audience does take place?

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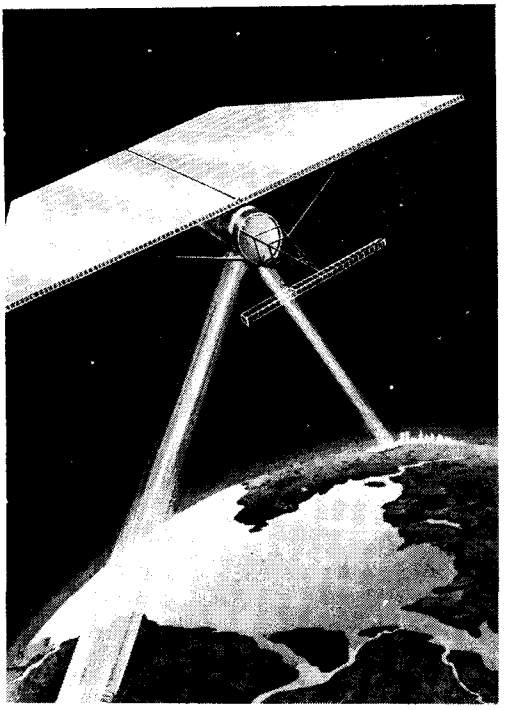

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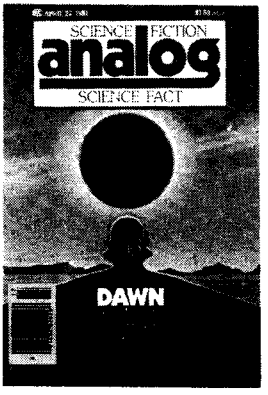

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Of course; you're reading one. Hardly anybody pays people to write science fiction that nobody is expected to buy. The writer who wants to make some or all of his living by writing science fiction must write stories which some editor is willing to bet his job that paying customers will enjoy reading. The customers let him know in no uncertain terms whether they did, both by their buying habits and by direct, vociferous comment. I know of no other field of writing that has such vigorous and constant feedback between producers and consumers.

Nor do I know of any other which, in my subjective but professional opinion, currently shows more vigor in the production of new work which the world—or some significant part of it—*will* note and long remember.

Coincidence?

I hardly think so.

Oh, it's not perfect, of course. I know all about Sturgeon's Law. I have no delusions that everything produced in this field is wonderful and unforgettable. But I do think our average is well above the current norms, largely because writers *must* try to please readers, and readers let them know where they succeed and fail.

Naturally, numbers alone don't tell the whole story. I know that the *National Enquirer* sells better than just about anything else, and I don't think that makes it great literature. Just between you and me, I don't think it has a very discriminating audience, anyway by *our* standards. We do. In science fiction we're not trying to sell to as many people as we can, no matter what. If we were, we'd get out of this business and imitate you-know-who. We've chosen one very picky group of people, and tried to sell as many of *them* as much as we can of what they like. That leads to an effective feedback mechanism, and as long as that group stays large enough to keep us in business, the feedback mechanism keeps working, honing the product and forcing it to grow.

I think music would be a lot healthier if it still had something like that. There are special problems there, of course. Symphony orchestras and opera companies are expensive to maintain, and the interested audience is not big enough to pay all the bills, even with ticket prices as high as they are. On that basis, you can build a good case for subsidies by private or public foundations, to take up the slack. They may also be useful for expanding the horizons of music by giving talented composers a chance to experiment with new ideas which are not "sure things" commercially. But letting that be the *only* source of new music is a sure road to *real* stagnation, or something equally unpleasant. How about a compromise in which a *few* foundation grants are available, but the recipients are also partly dependent on ticket sales—both for a significant share of their income, and for determining who gets the grants? "We'll support a way-out experiment for you," in other words, "*provided* you've demonstrated an ability to produce something *audiences* like in the reasonably recent past."

The problems in the sciences are not quite identical, but they're not all that different, either. One important differ-

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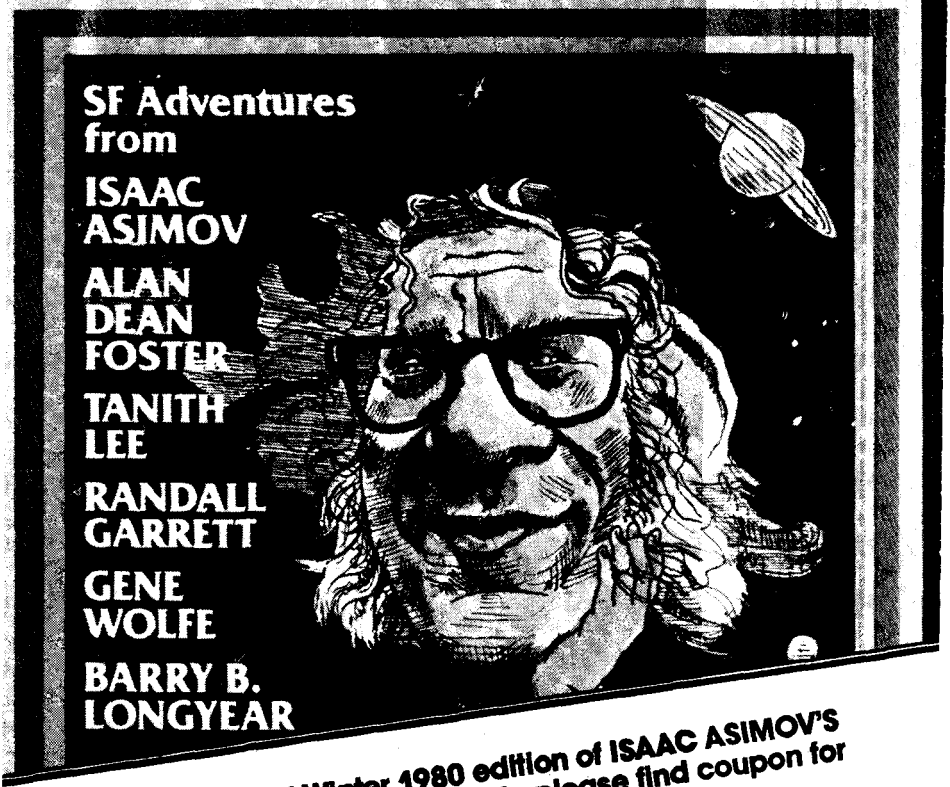

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ence is that the scientific analog of "experimental music"—basic research—has a clearer and larger importance (and there are more objective ways of evaluating its quality). One of the principal goals of scientific research is an understanding of basic principles, and that, by the nature of the beast, requires both theoretical and experimental work on problems which do *not* have any known practical applications. The practical applications will come later, providing some eventual justification for this important branch of science even for those people who are not impressed by mere understanding of the universe. But they will not normally come soon enough to make "sale of products" a viable way to support this kind of research, and in some cases they won't come at all. Unfortunately, there's no way to tell without doing the work. For such reasons, we're probably stuck with the "grant" approach for the funding of most basic research—though I'd like to hear suggestions for radically different ways. (Most of us would agree that Senator Proxmire doesn't understand the relationship between basic and applied research. But a great many *scientists* would also agree that much grant-supported research is done more to fill a publication quota than because of intrinsic interest, and many grants go to people resting on faded laurels who have become better at "grantsmanship" than real science.)

Most principles, of course, do turn out to be potentially useful, and applied research is the task of developing uses—applying basic knowledge to the solution of practical problems. Some of those solutions—e.g., improved nuclear waste disposal, fusion and solar energy, and other substitutes for oil—are urgently needed. Because they are urgently needed, they'll generate plenty of income when they're achieved. Therefore they *should* be of acute interest to private enterprise.

Unfortunately, we seem to have become addicted to the grant approach in this area, too (at least partly, no doubt, because of long payoff times), and there's a good deal of evidence that here it may be not just inefficient, but coun-

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terproductive. It is almost certainly a major cause of the "Study Syndrome" Jerry Pournelle wrote about a few months ago. As James F. Hudson, an industrialist who has evaluated proposals for Department of Energy R&D grants, wrote in *The Washington Monthly*, "Instead of encouraging technological breakthroughs by rewarding performance, the government discourages them with a grants structure that rewards inaction." Grants are given for a proposed *study*, not a result. There is no reward for *solving* the problem; if the researcher does solve it while working under a government grant, he can't even patent the result. He may even be *penalized* for solving the problem too thoroughly! If there's nothing left to study, he can't get a new grant unless he comes up with a *brand-new* idea—whereas a good grantsman can usually wheedle a new grant to continue something he "almost finished." Since many research salaries are paid *entirely* by grants, the researcher who actually *finishes* a project may be out of a job.

What can be done about all this? Lots of things. The basic counterproductive element, in science as in the arts, seems to be the elimination of effective feedback mechanisms for quality control when activities are supported entirely by grants. The composer who is paid to compose, without regard for whether he composes things people like, does not compose things people like. The composer who depends on ticket and record sales to pay his oil bills has to. The scientist who is paid to work on a problem, with no reward and possibly even penalties for solving it, is not likely to solve it.

In both cases, what we need is to get some accountability back into the system, with provision for both positive and negative reinforcement depending on *results*. The piper should be paid, but only when the rats are gone. We could start by removing some of the penalties—e.g., by allowing and encouraging successful researchers to patent their inventions. Matching grants, instead of full funding, could sometimes help. Reduction of federal grants may force those who really want to do science or art to find or create other funding sources which *are* responsive to results. Hudson makes a good case for the government's giving fewer *grants* (for *attempts* at processes) and more *prizes* (for processes that *work*). Big ones could give private investors an incentive to back longer shots than they otherwise would. H. Peter Metzger, a biochemist and syndicated columnist, suggests periodically reviewing careers and giving basic research grants to older scientists only if they have produced significant results in the reasonably recent past. (Sound familiar? Take another look at my proposal for grants to composers.)

The basic principle common to all these proposals is twofold: grants should not be too cozy or too permanent, and at least part of the piper's pay should depend on results judged valuable by satisfied customers. A *significant* part—he should not be able to live too well on a grant, or he may never bother with the rats.

Does it work? My experience, at least, says yes. One year when I was teaching college I took a year's sabbat-

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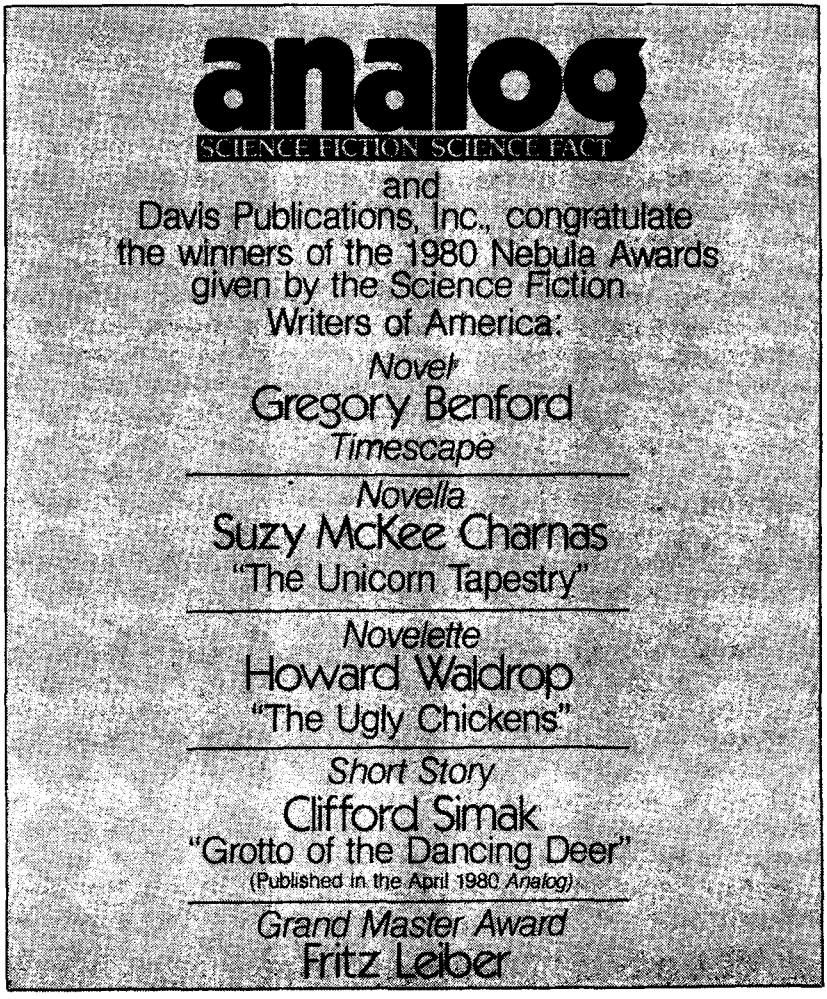
ical to write science fiction. For a year I was on my own; I had lots of time, and no one but myself to make sure I did anything with it. The college paid me half my normal salary, which was enough to survive on, if necessary, if I were extremely frugal. That was comforting, because writing is an uncertain business and I couldn't be sure anybody would buy what I wrote. But half salary was *not* enough to let me live in anything like the style I preferred, so I had a real incentive to write, and to write well enough to sell.

It was exactly what I needed. I wrote—as I had never written before. ■



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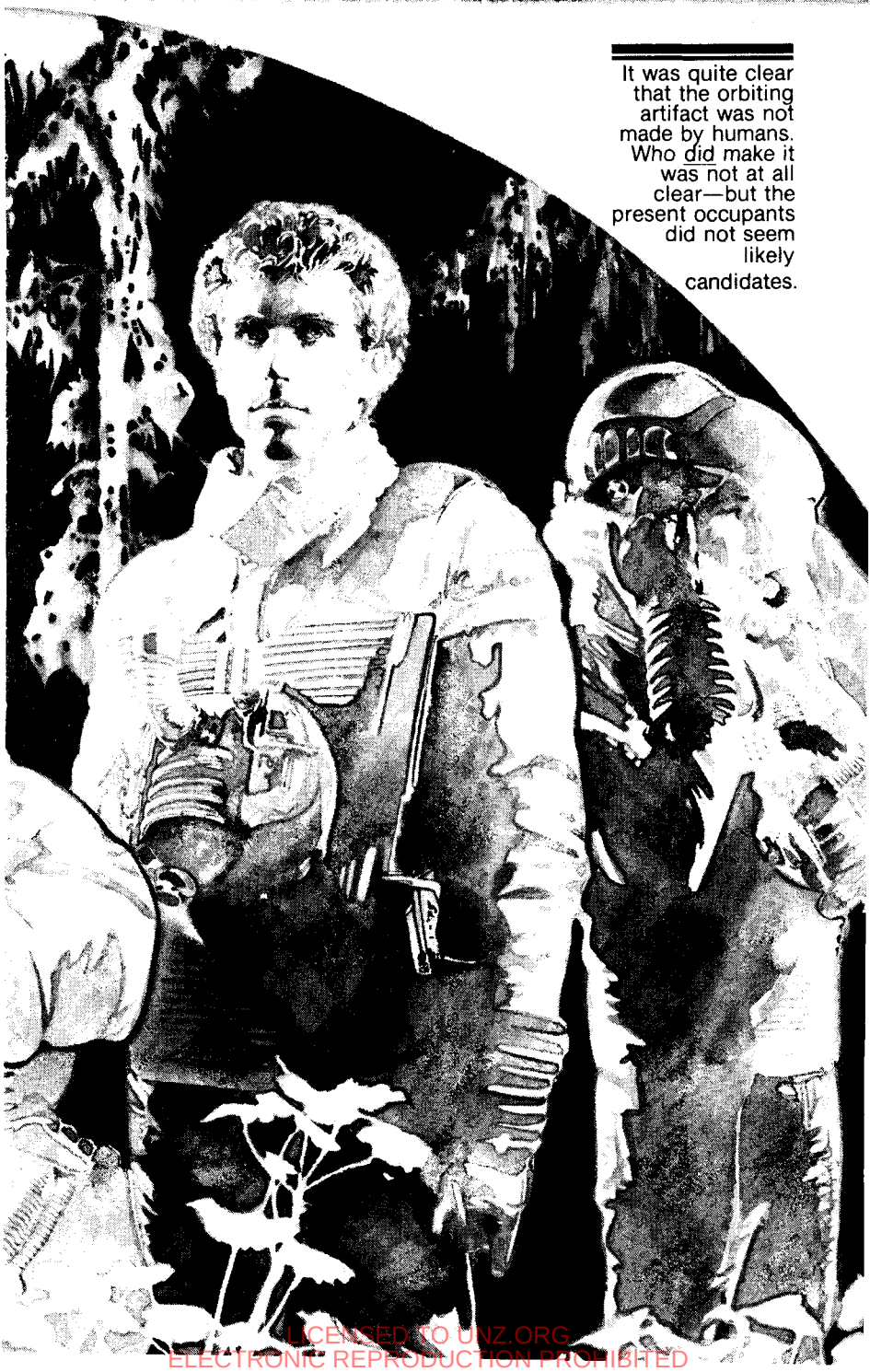
It was quite clear that the orbiting artifact was not made by humans. Who did make it was not at all clear—but the present occupants did not seem likely candidates.

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PROLOGUE

Something moved beyond the Barrier.

The sound stirred Garr from his thoughts and the dreamy half-sleep which had overtaken him. Guard duty was usually so monotonous it was easy to not remain alert. A lonely business, being on the night cycle . . . and standing sentry during just that portion of the night when most of one's fellows had locked themselves comfortably in the Dark Fold.

Now Garr was fully awake, listening. Something stamped through thick jungle, the sound of its great hind claws crushing undergrowth harshly. Whatever it was, thought Garr, it was *big* and it was coming close to the Watchtower. A ravenous cry pierced the blackness. Garr tensed. The beasts *were* getting bolder. Despite the boring nature of Dark Watch duty, more reports *were* being logged concerning beasts roaming closer to the Barrier. Though most waited till dark to begin their feeding, several species had begun to feed during the day—much to the distress of the maintenance crews who worked on the huge fortifications during the hours of light.

No light *now,* thought Garr as he peered over the edge of the Tower. The thing below neared his position, masked by the darkness. Anxiously, Garr tugged the latch of the Weapons Cage. Wakened, the tiny beasts within chittered and hissed. Garr didn't like waking them up: they complained so. But he didn't want to take any chances. With a gloved hand he reached in and grabbed one quickly. Dealing with squaves was second nature to a warrior. Upon detection of his scent, the specially bred lizard quieted, sheathed its needled claws, and wrapped its rudimentary wings close to its narrow body. Upon touching it, Garr felt the immediate subliminal contact of Master to Beast. Instinctively, the squave stiffened into firing position as it was brought up into the night air. Garr placed it into his Launcher. He cocked the bow and trained it upon the sound's seeming origin. The polished wood of its stock felt slippery as he traced its contours down to the trigger. He leaned over the edge of the Tower, which loomed high above the great wall of the Barrier. He wanted desperately to hang his lantern over the edge and shed some light on the creature. Always best to know the enemy. But Headquarters advised against attracting the beasts to lanterns if it could be avoided.

The sounds grew louder. Snapping branches. Muffled clumps of heavy hand-claws. Wheezing, bellows-like breathing. It was down there, coming closer.

Though it was his calling, Garr hated Watch duty in the Towers. You were so confined. So *alone.* And nobody closer than the next Tower down the line—more than 200 ems distant on either side. That is, except for the Prowl Beasts, and Garr never felt very comfortable around them without their trainers nearby.

There was no communication among the Towers other than by lanterns. A green light flashed each hour, downline to the right, if everything was secure. A red light shone anytime meant that all hell was breaking loose. You just always hoped there would be time to rig that red light and flash it.

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Scraping sounds. The rasp of claws against the wood and stone base of the Barrier.

The damn thing had picked up his scent, thought Garr. It was trying to get up at him. He could hear the beast mewling as it clawed at the base of the great wall. Too dumb to know that Garr was beyond its reach. Garr was grateful the walls of the Barrier were so smooth and steep. However, when any of the big carnivores got worked up into a real feeding frenzy, they did not exhibit such traits as cunning or patience to try to figure out how to deal with a wall. They just hurled themselves against it.

Unconsciously, Garr stroked the scales of the squave nestled in the wide groove of the launcher. Garr avoided the sharp spine that grew from the creature's head, which injected enough poison to stop just about any medium-sized beast. Arrows were available but the squaves were much more effective. Voracious little creatures, with the help of a Launcher they could be hurled at beasts at sufficient speed to pierce the toughest of hides. Even if they were not accurately fired, they could use their tiny wings to guide them toward the beasts. As often as not squaves were killed in the process, but if the beast were not quick enough, a squave could, with the help of its claws and needle-sharp teeth, burrow quickly into a beast and have a marvelous feast.

The really large creatures were fortunately too massive, too ponderous, to attempt any serious climbing of the walls. The only damage the really big bastards ever did was an occasional stumble against the masonry, knocking loose mortar and buttressing. More work for the maintenance crews.

That was the real problem, thought Garr. The Barrier itself. It was so old, so terribly old. Built so long ago that even the Priests were not certain of its true age, parts of it were always decaying, weakening. That, plus the prowling of the beasts, had required the systems of Watchtowers, which were strung along the great wall like beads on a string. All the way around the world.

More clawing, snarling. The creature was getting frustrated. He sounded like a good-sized carnivore. Peering over the edge, down into the murky jungle twenty ems below, Garr was unable to see anything. Even when he held the lantern over the edge at arm's length, there was not enough illumination to penetrate the black night. But the beast needed no light as long as it could smell its prey. . . .

The noises from the moist darkness increased. Guttural, slavering sounds. From deep in the thing's throat came the sounds of mindless hunger, of meat-gulping urgency. Claws scrabbled crazily against the stone.

What was going on? He'd never heard one of them act so persistently, with such determined commotion. Straining, he thought he saw the faintest of reflections and movements, but it was so dark below that the jungle could have been a bottomless pit. A pit of nightmares. They loved the darkness, where they could slither up behind you and—*chomp!*—that was the end. Just thinking of it made Garr's scales sit up on edge, his nostrils flare involuntarily.

Suddenly, the scraping sounds ceased. There was a pause in the beast's rapid,

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panting breath. For an instant, there was a silence in the jungle below: no small animal scuttlings, no clicks and murmurings of insects. Nothing. When one of the beasts was stalking, all the crawling and flying things seemed to vanish.

Another sound. It was walking away, Garr thought as he perceived footfalls on the matte of the jungle undergrowth. The footfalls stopped. Garr heard an unnatural groaning sound—the strain of wood and bark as a tree was being uprooted, and the sucking up of thick mud as its roots were pulled from the wet floor.

A muffled crash sounded as the tree smashed through the undergrowth. The beast must have been so crazed with hunger, it had stumbled into something, thought Garr. Soon it would be lost in the black depths, however, and there would be no danger. He brought the lantern in off the edge of the Tower, easing his grip on the Launcher, but still drumming his three fingers nervously against its solid stock.

Just as he was beginning to relax, new sounds floated up. The beast was *still* there. Its breathing increased, rasping the air. A new sound. Something was being dragged across the vine-tangled brush of the forest.

His scales tensed once again, his thin tongue whipping constantly in and out of his mouth. Garr listened, wondering what was happening below. Waiting in the darkness was too passive; he had to do something.

Pulling a rag torch from his supply chest, Garr struck his flint. The torch soon blazed with an oily flame, casting a blood-red glow upon the sparse interior of the Tower. Just as he leaned over the edge, holding the torch in his right forelimb, something jarred against the base of the Barrier. Something massive and heavy thundered against the Tower, shaking Garr from head to tail. The rag-torch fell from his grip and fluttered downward.

As the fire penetrated the darkness, Garr saw the thick trunk of a tree leaning against the Barrier, extending above the base of the Tower itself. The torch fell to the jungle floor, lighting up lush green surfaces . . . and something else.

A brief glimpse of something tan, or grey, moving quickly to avoid the heat and light. Then scrabbling sounds of claws against rough bark.

The torch flared once before going out. In that instant Garr saw how close the beast was, how terribly close. He felt himself thinking of when he was young . . . just reaching intelligence level after savage youth surviving the wilds where he'd hatched. He remembered vaguely moments like this, staring into the face of death. Yet somehow, he'd always escaped. . . .

Garr stared down at the creature, as if under a spell, his eyes locked in upon the thing which stared up at him with great eyes like flat yellow pools. It lunged forward. The eyes grew wider. Powerful hindlegs gouged into the tree bark. The thing surged upward in a final savage thrust.

Garr raised the Launcher in his hands, knowing he would not be quick enough. There was a flash of white teeth in the dying light, the glow of the lantern. The beast's mouth opened wide, as if unhinged, and closed quickly, snapping the Launcher and the squave in half, and

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taking off Garr's right forelimb in an instant.

The attack had been so swift, so surgically clean, that Garr had felt nothing. His nostrils flared as he took in the full scent of the beast's dead-blood breath. The great yellow eyes flicked and the jaws snapped once more.

It was the last thing Garr ever saw.

CHAPTER ONE

2027 A.D.
COPERNICUS BASE: IASA LUNAR COLONY

"We've got a problem," the professor had said on the phone.

The statement woke Colonel Phineas Kemp up fully. Problems were his meat and potatoes. That was why he was colony commander here, as well as chief of IASA Deep-Space Operations.

Problems were worth getting out of bed for at such an early time.

"Does it demand immediate action? I came over as soon as I could," Colonel Kemp said tersely, hiding his enthusiasm.

Professor Andre Labaté, director of the Lunar Observatory, stood over a bank of consoles, glancing at the illuminated display screens, mind seeming to drift away from the conversation. "Uhmm . . . no. No, it's not exactly of *that* nature, Colonel." Evidently the astronomy chief had been awakened early as well. His wavy grey hair was mussed, his off-duty clothing dishevelled. Kemp seemed to tower over the small man, even though he was not a tall man. He just cleared the height limitation for astronauts at 1.8 meters. His erect posture, well-proportioned, muscular body gave the impression of a tall presence. Despite his haste to get to the observatory from his quarters, Kemp wore a fresh uniform. He always looked crisp and professional. Sharp, clear-eyed, alert. That was the ticket. He wore his dirty-blonde hair fashionably long. His nose was sharp and hawkish, accenting his thin-lipped, firmly-set mouth. At thirty-seven years old, Kemp was the ideal media-image IASA astronaut. He worked very hard to maintain that appearance.

Impatiently, Colonel Kemp cleared his throat and waited for Professor Labaté to continue. The fellow had an irritating flair for the dramatic pause. Probably a throwback to his days in lecture halls.

"A problem, you said. . . ."

Labaté blinked, then nodded. "Oh, yes. Fascinating, all of this. Well, now. Let me give you some background information first. One of my graduate students—" He pointed to a dark-haired young man seated at a console across the room—the only other occupant of the observatory. "Name of Boucher. Robert Boucher. He was on-shift here about an hour ago. We've been running some routine measurements on the Tarantula . . . you know, the Great Looped Nebula. It's in the large Magellanic Cloud in the constellation Doradus. The biggest we know of its kind, with a diameter of eight hundred light years."

Speaking with soft urgency, Labaté moved his hands about as though in some scientific sign language. His thin grey eyebrows rose and fell emphatically. "Now," he continued, "part of our project concerns photometric anal-

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ysis. We set up a large array of aligned photometers, each focused on a small, sequential feature of the Nebula, each comparing radiation output from hard U.V. out to the near infrared. Three micrometer cut-off. Each photometer covers a small arc of the sky. Do you follow me so far?''

Kemp smiled patronizingly and nodded. He knew some of what Labaté was saying, but he let the man tell his story. Kemp shifted his weight casually and leaned against the edge of the computer console behind him, keeping his stare intent despite his feeling. *This couldn't be* that *important. An interesting astronomical discovery. No crisis.*

''We were getting reams of good hard data. Fascinating results, but totally reasonable. Until tonight.''

''Okay. I'll bite. What happened tonight?'' Finally it was coming out. He'd discover why the priority-intercept line had buzzed him from a deep sleep and he'd been summoned here.

''I'm getting to that. My grad assistant, Boucher, was sitting right here, monitoring the displays, when he noticed an unexpected *peak* on one of the photometers in the array.''

''Indicating what?''

Labaté shrugged. ''Any number of things. Boucher immediately checked the most obvious—instrument malfunction—but he couldn't find anything wrong. Could have been some kind of stellar eruption—a nova in Tarantula—but it was so brief we had to discount that kind of explanation.'' The older man drew a breath, exhaled. ''Boucher logged in the peak and continued to monitor the system, until he noticed that other photometers in the array were producing peaks *at regular intervals*. The display was linear for all intents, and each peak was equal in strength. Now Boucher's from Princeton—he's here on an IASA fellowship—and he's one of my better assistants. He immediately considered the possibility that the instruments were not picking up a disturbance within the Great Looped Nebula, but something far closer, something moving *in front* of the field of view. Follow?''

''Meteor storm? New asteroid?'' But no, Kemp thought immediately.

Labaté shook his head. ''Not very likely. Although whatever it was that was producing those photometric peaks was probably quite large, it's doubtful it could be a meteor swarm—too far away, not enough density. And we didn't like the idea of an asteroid because the photometer array is aimed so far off the ecliptic.''

''A comet, then.'' Jeez. This was getting to be like Twenty Questions. Kemp hated games and he could not hide the impatience in his voice.

Smiling, Labaté clapped his hands together. The sound was sharp and surprising against the soft hums and general low noise of the room. ''That's very good, Colonel. *Very* good. All evidence seems to point towards a comet, doesn't it? Indeed, that is what young Boucher imagined. Boucher's comet indeed. The lad was ecstatic.'' He chuckled, gazing over fondly at his astronomy student.

Kemp surmised the obvious. ''*Not* a comet then.''

''Odds are very much against it,'' Labaté said crisply. ''Unless it's like no comet any of us have ever seen. Boucher called me about an hour ago, several

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minutes after he picked up on the peaks. We ran a spectroscopic analysis of the object, continued tracking it, and finally compiled a rough set of orbital elements. It's heliocentric, no doubt about it."

"Did that clarify anything?" This *was* strange. Something in a solar orbit. Any object large enough to peak a photometric array might be very large indeed. Something that big, hurtling down the gravity well towards the sun . . . perhaps this was a problem, or could become one.

Labaté nodded. "A few things. The object is following a fairly classic cometary-orbital pattern, close to parabolic. Its distance, when sighted, was about 800 million kilometers—about the same as Jupiter's orbit. Spectrographic analysis gave us Fraunhofer absorption lines, which was odd, if it was going to be a comet. We then checked for Doppler shift on the sodium D line, as part of the range-rate measurement. As you know, there's no absorption to speak of between here and Jupiter's distance."

Sounded right, but Kemp was not totally sure of the implications. His knowledge of astronomy and astrophysics was comprehensive, but only on the survey-level. He was about to ask Labaté to clarify when the old man began speaking again, his hands twitching even more animatedly.

"So we ran some spectrographic comparisons and found that the orbital spectrum was an *exact match of the solar spectrum*, slightly shifted by Doppler effect. Do you understand what that means?"

Kemp had played along so far, but he was getting weary of this. Phineas Kemp could be polite as necessary to humor anyone, but he wasn't by nature a mild man. He knew how to wield both politeness and sternness. Both played a part in leadership, and it was the latter that he began to employ now, with steely efficiency.

"I'm not sure I do, Professor. But if this is indeed as important as you think it is, you had better stop playing teacher and start filling me in with the straight scoop."

Blinking and cringing a bit, Labaté seemed a little surprised at the rebellion of his temporary student.

"Well, I'm not *sure* what it is, mind you. But it appears to be something very large, and with a highly reflecting surface. Smooth enough to produce photometric peaks whenever that smooth surface faces the sun and reflects back the light. Whatever it is, it is probably engaged in some kind of slow, but regular, tumbling motion—hence those regularly spaced, timed, peak-intervals."

"I see . . . and this behavior is unnatural for any known solar system bodies?"

Labaté shook his head. "There's nothing out there that *we* know about with an all-wavelength better than .99, Colonel. *Nothing!* And don't forget those first-look orbital elements. It has come in from a long way out. Maybe as far as Pluto."

Kemp looked away from the professor, glancing absently at the banks of instruments and displays within the Lunar Observatory. Beyond the instruments yawned a large observation bay window which presented a view of the sloping shelf upon which the Observa-

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tory rested. Spreading out into the main depression of the crater lay the sprawl of dome-structures which comprised the Lunar Colony. Beyond the Colony, the short horizon of the moon edged out the velvet-black sky. Somewhere out there, thought Kemp, an object was hurtling towards the sun . . . towards mankind.

"How long before you'll have some more hard data?" he asked Labaté.

"Not long. Another hour and we will have enough to make some more correlations. If the object has an unpowered orbit, we will have a good lock on it. We will have velocity, period, eccentricity, semi-major axis . . . maybe its size and mass."

"Right," said Kemp, employing all his authoritative manner. "I'm going to have to put a security blanket on this project. I'm sure you're aware of that, aren't you, Professor?"

Labaté sighed. "I was expecting it. I'd be surprised if you didn't."

"How about Boucher? We can't let this information slip out. Could get in the wrong hands. Has he been in contact with anyone since the beginning of this business?"

"Absolutely not. Only me."

"Very well. I want you to assume command of this operation. Boucher will be assigned to you, and will remain here. I'll have Rheinhardt provide you with meals and some security personnel, if this thing drags out to a few days and you two need sleep. In effect, you're going to be confined to the observatory."

"I practically live here anyway. Boucher, though . . ."

"We'll have to issue some kind of cover story for your confinement. Security will take care of things. From now on, all communications to and from the observatory will be classified and on Security Intercept. I'm going to convene a meeting of the Joint Directors right away . . . that is, as soon as you get the rest of the hard data collected. When you tie down an orbit, I want you to present the information to the Staff." Kemp adjusted the collar of his uniform, cleared his throat. "Now, tell Boucher I'd like to have a few words with him. . . ."

CHAPTER TWO

With a tentative smile, Becky set the plate down before him. "Best I could do at such short notice," she said, wrapping her dressing gown tighter around her slim body.

"Thanks," said Kemp. He picked up a piece of toast and began to munch it between sips of steaming, aromatic tea. He scanned the preliminary readouts that Professor Labate had provided.

"Joint Directors meeting in an hour, huh?" said Becky, settling down with her own plate of soy-sausage and scrambled reconstituted eggs.

"Yeah." The hard facts had come in, and they'd been absolutely incredible. Labate was going to present them to the meeting, implications and all. That was going to be some meeting, all right. "You stuck around just to find out what was going on, right?"

"I stuck around because I fell back to sleep, Phineas." Her dark and attractive Semitic features lost their smile. "I just happened to overhear—"

"And you're just dying to know what

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all the hoopla is about. I know you, my dear. I don't blame you. I'd be the same way. But frankly, this is classified stuff. I can't tell you."

She wiped her long black hair away from her face and glared at him, ignoring her meal. "You know, Phineas, you're probably the most tight-assed man I've ever met. I truly resent your lack of trust in me. I want to talk about it. It goes deeper than just this and—"

Kemp cut her off with a single cold and curt word. "Later."

She blinked her dark brown eyes in a vexed manner, and then settled down into a surly silence over her breakfast.

Too bad she'd stayed the night. This wouldn't have had to happen. Rebecca Thalberg was the one person he really didn't like to treat this way. But the qualities he admired most in her—curiosity, intelligence, and a cute stubbornness —were also the things that caused them to occasionally lock horns. Still, he loved her. She was different from the other women he had known. And Kemp had known plenty of women. They were attracted to his rugged good looks, his abrasive, cocky demeanor, his status as a rising star . . . a man to be respected and listened to. A man in *control*. But Kemp's affairs with women had always managed to be such ephemeral, casual liaisons. They'd never seemed to be able to delve beneath his surface, and he'd never sought to know them in any other way than physically. Rebecca was different. She'd met him will to will, and demanded that he know her as a person. Kemp had chosen to do just that, and there were moments, like this, that he regretted that.

Still, she was a beautiful woman. He liked the way her raven hair was parted in the middle, with little curl or additional arrangement—the way it framed her oval face. He liked the way her high-breasted body shone with health and warmth. She was the coordinator of Copernicus Bio-medical Division, clever and intelligent, gentle and loving . . . and sometimes a royal pain in the ass.

He played with his eggs as he concentrated again on the figures, reading them over again to make sure his eyes hadn't played tricks on him.

A large unidentified body was entering the main plane of the solar system at an oblique angle, out near the orbit of Jupiter, approximately forty degrees to the ecliptic. Cometary orbit with a period of about 200 years. Velocity, thirty kilometers per second, increasing as object approached perihelion, closest position to Earth before heading back out.

The thing was some kind of cylinder, 320 kilometers in length, 65 kilometers in diameter.

And it wasn't a comet, either. Labate's mass estimates indicated that neither was it a solid body.

Question was, just what *was* the thing?

He swallowed the last of the tea, packed the papers together and placed them in his briefcase. He pushed the half-eaten breakfast away and stood to go and brush his teeth, still feeling baffled and excited and . . . somehow, distant. If Labaté's wild notion were reality . . . the thought just took one's breath away.

"You're not finishing?" Becky said, trying to take the sourness out of her

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voice. She wasn't one for holding grudges, though when her temper flared, it was scorching.

"No. I'm sorry, but I'm just not hungry. This is pretty important stuff, Becky. I . . . I *do* wish I could tell you about it but—"

"I know. You're a stickler for rules. Especially for you *own* rules. Never sleep with your girlfriend more than three times a week; it takes too much time and attention away from work otherwise. Never take more than a half-day a week off. People depend upon you. Never say 'I love you' other than when absolutely necessary. Makes your lover too smug and self-assured and hard to handle. Have everything in control. Never let loose of too much emotion. Kemp's Commandments." She spoke blithely, with no bitterness.

"I do love you. You know that."

"Do I? Hmm. I guess the only reason I put up with your crap is that I love you too."

"Rotten luck, right?" Relieved, he gave her a boyish grin.

"For me, maybe. You seem to handle yourself pretty well."

"Thank you for staying, Becky. Thank you for breakfast." Almost reluctantly, she accepted the invitation of his open arms, hugging him softly and firmly.

"One promise," she said.

"Which is?"

"You'll tell me what all this was about at least one minute before you are officially allowed to."

"I think that can be arranged."

The shuttle whined to a stop. Phineas Kemp jumped onto the subway platform. The terminal was almost empty at this early hour since the night shift—a skeleton crew anyway—was still on duty, and the day personnel were probably still sleeping. Kemp took the elevator to the top floor of the Admins Dome, the only level located on the lunar surface.

As he entered the office complex, he nodded curtly to the Security woman on duty. He walked straight through to his office, adjacent to the conference room. Soon that chamber would be occupied by the Joint Directors, sealed off from the rest of the base under a Level One Security net. Kemp knew that he should be preparing some kind of introductory speech, something to quickly explain the nature of the emergency conference, but the words would not come to him. Instead, thoughts of his father kept interfering. Kemp tried to temper those memories by asking himself how his father might handle the impending situation. The old boy had indeed had quite an effect on him, Kemp thought, smiling with a touch of sadness.

Kemp walked to the broad, curving slope of smoked glass, the executive-sized window which gave him a spectacular view of the northern quadrant of Copernicus Base. Roughly a hexagon in design, the Colony was a series of domes and geodesic structures connected by underground tunnels. Eighty percent of the Colony was located beneath the surface of the crater basin, partially for protection from the infrequent meteorite showers, but primarily because it allowed a more efficient use of lunar construction materials. Copernicus Base was the oldest permanent lunar settlement. Hard to believe it would soon be celebrating its thirtieth

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anniversary. During that time, it had grown from its original complement of 28 men and women to its present permanent population of 860. Copernicus was the first extraterrestial small town, containing everything from a general store to a village barber shop.

Kemp supposed that the base would remain the crowning achievement of technology until the L-5 Colony progressed beyond the planning and financing stages and actually began construction. At thirty-seven, Phineas Kemp was proud to have been placed in charge of Copernicus. An honor, yes . . . but he always felt that his appointment had also been a testament to his exemplary record as an astronaut. His record of space 'firsts' would never be equalled, and he often imagined that his name would find a place in the history texts beside Lindbergh's, Gagarin's, and Armstrong's. There had been a time in Kemp's career when he thought about this kind of papery immortality so much that it seemed to be his consuming passion, the driving source of his energy and utter competence. His father had always wanted him to be the Best—the best at *whatever* he attempted—and he had dedicated his life to that end.

But now, as Kemp saw the age of forty rapidly approaching, he also sensed a subtle change in his attitudes toward life in general, his *own* life in particular. Some of the things which had seemed so important earlier had lost their fascination. Priorities were slowly shifting, rearranging themselves in his mind, and there were times when Phineas Kemp actually felt insecure, actually felt unsure about how he would conduct his future affairs.

Smiling, Kemp shook his head slowly as he stared up at the blue-green jewel that was the Earth. His colleagues perceived him as astute, authoritative, decisive, unshakably calm, and ambitious. He did not want them to alter their opinions one jot. And yet . . . he was getting tired—tired at such a young age. It almost seemed criminal to him. He thought of his father, and how that man had driven himself and his small Canadian semi-conductor company to the heights of the industry, wondering how embarrassed he would feel to know his son was . . . what? Growing *bored* with over-achievement? *Impossible! Bullcrap!* the old man would have said, and Phineas would have agreed with him.

But something was happening to him. Things were changing. He thought it might be Rebecca. Perhaps that 'urge to settle down' his mother had confidently assured him would strike him someday was slowly sinking its sedentary hooks in.

Kemp looked down at his watch. They were all late. He'd been the only one on time. Typical. They'd all feel pretty bad when they discovered the importance of the meeting. Something had to be done immediately, before Ramadas Khan Base got word of this business. That could be a very sticky situation. He glanced again out the observation port. The Earth, covered with angel-hair wisps, hung several degrees above the horizon. It looked so close that one might be able to reach out and touch it. His home . . . but he'd never be able to appreciate it again. No. Almost instinctively, he knew that his des-

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tiny lay somewhere beyond the Earth, in the stars. He'd known that, or sensed it rather, since his early adolescence when his father helped him build a telescope from the Edmund Scientific Company. After all the hours in the dusty basement, grinding lenses, machining the fittings, mounting everything, it had been such a joy to take the instrument out into the crisp, black night in the back yard where the universe peered down at him. Some called it a sense of wonder, of coming to terms with the boundless cosmos, but Kemp called it a sense of destiny.

The intercom chimed.

"Security, sir. Doctor Labaté, Major Rheinhardt, Doctor Kolenkhov, and the rest of the Joint Directors have just arrived."

Kemp closed his eyes almost solemnly, thinking of Labaté's closing words to him, *"Yes. Yes, Colonel. It looked that way. Some kind of spaceship. Chances are good. An* ALIEN *spaceship."*

Kemp said, "Send them in, please."

CHAPTER THREE

Like a gigantic insect, the *Astaroth* hung in the blackness of space, hovering silently.

The general symmetry of the cylindrical ship was broken by a series of three-dimensional trapezoids—the outer bulkheads of its great ore-holds. The bow comprised two command blisters which resembled multifaceted eyes—further enhancing the insectoid look of the enormous vessel. Within its hull labored the ore-crushers, the processors, and furnaces. The *Astaroth* was a self-contained factory in space which provided metals and alloys to the IASA moonbases and Bradbury Station, the Mars colony.

On the belly-side of the ship hung a series of launch-bays—each platform holding two and four-man ships. These smaller craft, officially designated as SP-2s and SP-4s, were nicknamed "Snipes" by the miners. The little ships were employed primarily as surveying prospecting vessels and were crammed with all manner of detection and measurement gear. Shaped like teardrops with the point-ends truncated, the Snipes were powered by small but efficient MHR reaction engines. They had exceptional range and maneuverability, and were equipped with retractable 'grapples'—servo arms which allowed the Snipes to attach to the rough-contour surfaces of asteroids and ferry them back to the *Astaroth's* ore-holds for crushing and processing.

At Launch Bay Six, Peter Melendez and "Big Chuck" O'Hara climbed into their Snipe, sealed the hatches, waited for bay-decompression and subsequent ejection into space. They had, only minutes previously, been ushered from Major Franco's office after receiving concise, if mysterious, orders.

Neither man had spoken since entering the ship, other than to verify prelaunch checks on their consoles, but when the routine task had been completed and final countdown had commenced, O'Hara nudged his partner and put a hand over his throat-mike. "What do you figure's going on?" he asked in a husky whisper. O'Hara was a large, beefy man. His face was round and

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freckled, his complexion always on the florid side. He looked like a hard drinker and would have been if IASA regulations were not so strict about such things. It had been more than five decades since man had entered space, and more than two decades since the frontiers had been opened up for the common man—the blue-collar, workaday types who would build Earth's extraplanetary empires. Big Chuck O'Hara was one of those men. He was a miner, with a miner's view of the world, whether back on Earth or out in the asteroid belt.

After hearing O'Hara's question, Peter Melendez only shrugged, then indicated that they wait until their mikes were not patched directly into the *Astaroth*. Melendez was almost a perfect opposite of O'Hara: small of frame, delicate features, soft-spoken, and well educated. He had been working on a post-graduate degree in sociology at Cornell several years ago, when he abruptly became bored with it all. He acquired a wanderlust which eventually led into space—the IASA Mining Division being the only branch of the service which would accept him. After a quiet life of safe, dilettante experiences, Peter Melendez had decided he would cast it aside for a sample of the rugged existence of the "new frontier."

As the countdown ebbed away, Melendez glanced over at his partner. He had been running missions with O'Hara for more than three months, and Peter was growing tired of the man's abject boorishness. Their cabin conversations comprised little more than O'Hara's running monologues about women and tales of his physical prowess in fights.

Melendez was beginning to think that the new frontier was not so very new after all, and he had been having thoughts of going home. But now his blood was up. Something odd was going on, and Peter was curious to know why Major Franco had sent them out on a very secretive recon mission.

A lurch. A sudden assault of G-forces. The Snipe catapulted from the launch bay. Automatically the engines cut in, stabilizing the craft. The intersect coordinates had already been keyed into the Snipe's onboard computer, and the little ship began burning through the darkness towards a predetermined rendezvous point. For the moment, at least, O'Hara would have little to do in the way of piloting the craft.

"Pretty strange, isn't it?" croaked the bigger man, rubbing his mouth with the back of his hand the way he did when he hadn't had a drink all day.

"I guess so," said Melendez, pretending to be carefully examining his consoles of detection and recon gear. "Wait a second, will you?"

The radio crackled in their headphones. "SP-2 double A, this is Big Mother. We have an A-OK launch here. Do you copy?" Major Franco's voice.

"We copy, Big Mother," said O'Hara. "Launch is normal, and we are locked into programmed flight."

"Stand-by, SP-2 double A. Further instructions to follow. Out."

O'Hara flipped off the radio and looked at Melendez. "Now tell me, what do you think is goin' on? And what'd you mean—you *guess* so?"

Peter Melendez looked up from his consoles. O'Hara's face was a mixture of curiosity and intimidation. "I don't

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know what to make of the secrecy, if that's what you mean. We're supposed to run a recon mission. You know as much as I do."

"Which ain't much," said O'Hara. "And I thought you college guys were supposed to be so smart! You don't know nothin' . . ."

"Hey knock off, will you?" Melendez attempted to keep the anger from his voice, hoping that an honest plea for something approaching camaraderie might be successful.

"I'll tell you what *I* think. I think it's them friggin' A-rabs. They've probably got some kind of ship out here in our territory."

"I doubt it," Melendez responded. "The TWC doesn't have any ships that can operate this far out."

"Then what the hell is it we're supposed to be lookin' for?"

Melendez sighed. "You heard what Franco said. Copernicus picked up some kind of object through this quadrant and they want a close-up look. That's *all* he said, for god's sake."

"Well, I was just thinkin' . . . you don't think they'd send us out here to do anything . . . you know . . . *dangerous?*"

Melendez shrugged. "How the hell do I know. I mean, look at our *jobs*. They're not exactly what I'd call safe."

Their helmet phones crackled again as Major Franco's voice cut in: "Okay, SP-2 double A, our telemetry is affirmative for a Number One intersect. Autoguidance until you achieve a visual contact. Manual after that. Do you copy?"

"We copy that," said Peter. "Can you tell us what we're going to be making visual contact *with?*"

"Negative. When you get within range, I'm told you won't be able to miss it. That's all I can tell you right now. Proceed on course. When you make visual, you will be patched in to a Priority Channel with Copernicus on a scramble sequence. You will have to validate before beginning the transmission. Frequency 204.8. Do you copy?"

"We copy," said Melendez. "What is present ETA?"

A brief pause. "For visual, or course intersect?"

"Either one will do."

"ETA for intersect is 32 minutes. Can't give you visual . . ."

"Why not?" Melendez did not like the tone in Franco's voice.

"Sorry, SP-2 double A. I can't talk about it. We are standing by for visual confirmation. Big Mother, out."

"Roger, Big Mother," said Melendez, flipping off the transmission key.

"He can't talk about it," said Peter. "That's crazy, isn't it?"

O'Hara harrumphed. "Ain't the only thing that's crazy. Like how come they picked you for this mission. Me, I can figure . . . I been with this outfit for almost ten years—they *know* I'm good. But you! You ain't been space-boomin' for more than a year or so."

Melendez smiled. "I learn fast, I guess." He did not really feel like talking to his partner, especially when he was in one of his argumentative, aggressive moods. Peter Melendez *did* share O'Hara's apprehension concerning the mission, but he did not want to talk about it. They would know what they were looking for soon enough. He

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stared through the forward port into the endless velvet night.

Neither man spoke for several minutes. There was a tension in the atmosphere of the small ship's cabin, but Melendez was able to ignore it by directing his thoughts outward, to the possible reasons for the recon mission. It *was* possible that the brass had picked up a TWC ship in the vicinity. Was it armed? Disabled? Maybe no one knew what it was doing out here. The thought was troubling. The Third World countries were not very advanced in space technology. Indeed, the only thing they had actually accomplished was a lunar settlement. Aside from the two IASA moonbase installations—Copernicus Base and Tsiolkovskii Base, both staffed by the combined space agencies of North America, Europe, and the Soviet Union, there were two other permanent colonies: a fledgling enterprise recently established by the Chinese—Dua Ho Chang, and an older installation erected by the Third World Confederation —tagged the TWC. That base was called Ramadas Khan and it was the final glorious breath of the TWC, having been built soon after the close of the twentieth century when the emerging African nations and the Arab political estates were at the peak of their power. Within the intervening quarter-century, however, after the oil-depletion leverage of the Third World had been exhausted with the extinction of petroleum, the TWC became a second-rate political influence in global affairs. Since that time, the TWC had clung to their moonbase, recognizing it as a final vestige of their past glory, even though they were partially dependent on the IASA for logistical and technological support.

If it was a TWC ship, though, why were they sending out a Snipe? wondered Melendez. Tensions between the IASA nations and the TWC persisted, to say the least. In fact, there was an unspoken tradition of hostility, and several "incidents" within the past decade could have easily escalated into direct military confrontation, had not the diplomats of the involved countries been quick to ameliorate the disputes. True, the world did not hang in such precarious balance as in the previous century. But the utopian vision of political and economic harmony among nations was still quite distant.

As far as Melendez knew, though, the TWC just didn't have the hardware to get out here. Their deep-space vessels were obsolete and their telemetry equipment was ten years behind state-of-the-art.

So what was it they were going after?

Melendez's thoughts kept tumbling over and over, and he wanted to verbalize them, but talking to O'Hara was not fruitful, to say the least. The man did his job, and that was all.

Checking his watch, Melendez realized that they were within 15 minutes of ETA with the object. He stared absently through the port, into the bottomless pit of stars, remembering how it had been when he'd first ventured into space. Now, he had overcome those early feelings of fear and insignificance, but there remained a sincere *respect* and a sense of wonder about the universe. Melendez felt that he truly appreciated the vastness of the galaxy, the implications of the hundreds of millions of

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suns which burned in the darkest of nights. Here he was, a speck of bone and blood, a smear of chemicals crawling this immense canvas. A cold, insensitive place, it made you appreciate the only true warmth in the universe for human beings—the warmth of *other* human beings.

Something flickered on his long-range scanner displays. The instruments were picking up an object. Other sensors were also flashing into screen-brilliance. A solid object of incredible proportions . . . Melendez keyed in a request for some preliminary figures.

The display blinked. Numbers appeared.

Distance from object: 41,000 kilometers. Mean dimensions of object: 321.45 kilometers by 64.78 kilometers.

Melendez re-keyed the request. Couldn't be anything out there *that* big if it was a ship. Theirs *or* Ours. Surely, if it was an asteroid, the Survey would have known about its existence a long time ago, especially if it was off the ecliptic.

The display screen blinked. The same numbers reappeared. Melendez checked again, just to be certain before contacting the *Astaroth*. No error. Whatever it was, the Snipe was gliding toward it at a speed of six kilometers per second.

"Hey, Chuck. Look at this," Melendez said in a soft voice.

O'Hara looked. "What the hell is it?" His tone of voice had changed from condescension to a milder feeling.

"Don't know. We're not in visual mode yet. But it's damned big. We should be seeing it soon. . . ."

"You'd better get the *Astaroth*."

"Yeah." Melendez keyed in his mike. "Big Mother, this is SP-2 double A . . . Do you copy? SP-2 double A, calling Big Mother . . ."

"Big Mother here." Major Franco's voice swept through the phones.

"Major, we have scanner-contact." Melendez read out the incoming data. "Visual will come momentarily. It's *big*, Major."

"Affirmative, SP-2 double A. I have orders to patch you directly to Copernicus now. Good luck, gentlemen. Big Mother out."

Static crackled, followed by a series of bleeps and clicks as the scrambler codes activated. All transmissions from the Snipe would now be beamed hundreds of millions of kilometers back to the moon. Travelling at the speed of regular radio waves, communication from the asteroid belt to the lunar surface would have required a 15-minute time-lag between transmission and reception. Thus, an inquiry and the reception of an answer would consume a half-hour of real time. Communication over the immense distance within the star system would be frustrating if the IASA were constricted by the old laws of relativistic physics. Indeed, the discovery of the tachyon—that particle zipping along at hyper-light speeds, incapable of deceleration *below* the speed of light—which made deep space operations feasible. Deep space communications were accomplished by means of a tachyon wave-generator.

Peter Melendez keyed in the proper frequency code, which would validate the Priority Channel transmission, and waited.

At Copernicus Base it was early after-

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noon. Business as usual for the majority of lunar base personnel. Almost eight hours had passed since Phineas Kemp had convened the meeting of the Joint Chiefs. Only a handful of high-echelon Copernicus staff knew of the as-yet-unidentified object. Kemp was pleased with the efficiency and smoothness of Oscar Rheinhardt's Security operations.

Copernicus Base hummed with the life of the hive: farmers, mechanics, technicians, scientists, administrators, pilots, all busily engaged in their duties, all necessarily unaware of the drama about to unfold in deep space, thought Phineas Kemp.

Attired in his informal officer's jumpsuit, he paced back and forth in the Communications Center, waiting. Waiting and brooding. The room was empty except for Major Alterman, director of communications for Copernicus Base—one of the few personnel briefed on the current security topic. The room was bathed in a soft darkness above, illuminated only by the operational lights on the consoles. It was cool and quiet, with the relaxing murmurs and thrums of smoothly functioning machinery permeating the atmosphere.

In contrast, Kemp felt tense.

The image of the reactions of the Joint Directors to Labaté's pronouncements still registered on his mind. Kemp realized they were merely reflections of his own awe. The words reverberated in his mind.

". . . *initial sign of its presence was a series of luminosity peaks. These peaks were caused by the specular reflection of solar radiation off the surfaces of the object—flat surfaces,*" Professor Labaté had told them. "*The intervals between reflectance peaks indicate that the object is rotating about a principal axis of inertia. It's an immense cylinder, tumbling end-to-end through space as it approaches the sun. Whenever the flat ends of the cylinder face the sun, we get a bright flash of reflected radiation and light. Spectrometer readings suggest that it is of a metallic substance of uniform characteristics. The object is emanating some kind of VLF electromagnetic field. So far we have not been able to identify its nature, although the parameters indicate something of a fairly large order, well within the limits defined by a controlled fusion reaction.*"

They'd immediately realized the implications of that. Kemp's own words had almost been superfluous. "*A ship. Evidently been there in orbit for a sizable amount of time. Some product of an alien civilization.*"

The expressions of the others had changed rapidly, passing through stages of shock, flickering briefly though a spectrum of awe and confusion, finally settling into acceptance. Excited acceptance.

Security measures previously implemented by Kemp had been reinforced by Oscar Rheinhardt, security chief. No doubt neither the Chinese nor the Khan base had any idea of what was out there. Their equipment was not as good. Still, they could take no chances. The discovery was of immense political importance, to say nothing of *scientific* significance. Officially, the observatory claimed it had had a hardware crash on the machinery pertinent to the discovery, and was awaiting repairs.

Because it would take an estimated

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four weeks to reach the object if they deployed one of the ships in the lunar area, it had been decided to use a DS mining operation in the approximate vicinity of the object's closest approach to the asteroid belt. Two ore-processing ships were within range: The *Astaroth* and the *Cassandra*. The mission commander of the *Astaroth* was a former crewman of Kemp's . . . Major Altimiras Franco. He could be trusted. The Joint Directors had agreed.

He was in charge of the first operation with the chance of contacting an alien intelligence. How about that, Dad, Kemp thought to himself as he waited. How about that.

Alterman looked up, his beard strangely underlit by the instrument lighting. "Colonel, we've just gotten word from the *Astaroth*. Their Snipe reports instrument-contact with the object and Major Franco is patching us in."

Finally! thought Kemp, turning quickly and returning to the central console. He slid into a chair next to Alterman, strapping a throat mike to his neck quickly. "Thank you, Major. Ready when you are."

"The Snipe's just keyed in his scrambled sequence. Go ahead, Colonel."

"Copernicus Base, calling SP-2 double A. Do you copy?"

"This is SP-2 double A, Copernicus. Spec-5 Peter Melendez on the com. How is my signal, Copernicus?"

"We copy, SP-2 double A. This is Colonel Phineas Kemp, Melendez. What have you got for us?"

As the Snipe crewman repeated his initial data material, Kemp nodded to himself, then signaled Major Alterman to contact Security Chief Rheinhardt, Scientific Operations Chief Marcia Bertholde, and Gregor Kolenkhov, chief of support operations, a summons which would bring them immediately to the Communications Center from where they waited on stand-by, quite close.

"We copy that, Melendez," Kemp said. "You should be getting a visual any minute now. In the meantime I want all instrument-data on telemetry."

"Roger, Copernicus. Stand by, please."

Several panels on the console began flashing and blinking within three seconds. Display screens began accumulating rows and columns of data. Kemp nodded to himself as he spoke again. "All right, SP-2 double A, we have a copy on your telemetry. Copernicus Base is standing by until you have visual confirmation."

"We copy," said Melendez. "SP-2 double A, standing by."

Kemp leaned back in his console chair and exhaled slowly. The feelings of tenseness mixed with ennui had been extinguished—at least for the moment. Memories flashed through his mind, and he briefly recalled scenes from his years in space. The claustrophobic cabins, the eternal night always threatening to swallow you up, tension as thick as the smell of your sweat. Kemp remembered and he wished that it was *him* in that Snipe, drawing close to the unknown object.

A door slid open at the far end of the chamber. Turning, Kemp saw the other members of the Joint Directors enter quickly. The expressions on their faces betrayed anxiety mixed with excitement.

Kemp motioned them over to the con-

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sole, and began to explain the current situation.

After keying out the throat-mike, Melendez turned to O'Hara. "Kemp! Colonel Phineas Kemp. Commander of Copernicus Base, and he was talking to *us* on Priority Channel."

O'Hara was staring straight ahead, as though afraid of what he might see looming from the darkness. "I don't like it," he said softly. "We've been thrown into something big, Melendez. Why else would the top brass be interested in what we're doin'?"

"Yes. My feeling exactly. For once in my life, I think I agree with you." Melendez smiled to relieve the growing tension, but O'Hara was in no mood for it. The larger man grimaced and returned his gaze to the forward viewing port.

"Jeez! What's *that?* See it? Something just flashed!"

Melendez had trouble speaking. "Yes. We're closing on it. Relative velocity down to 5 plus. Hang on . . ."

O'Hara obeyed, then breathed deeply several times, nervously rubbing his lips with the back of his hand. "Bigger every second. Christ almighty, that's it! Look!"

Staring into the speckled night, Melendez concentrated on something shining with grey-whiteness . . . a metallic glint. The object appeared to be a rectangle, much longer than it was wide, growing larger. As the Snipe homed in on the object, the resolution became more clear, the configuration more distinct.

An immense cylinder. Slowly tumbling, end over end . . .

O'Hara cleared his throat. "I seen a lotta rocks in my time, but I ain't seen nothin' like that. Ain't no asteroid, that's for sure."

Melendez realized he was gawking. "I'd better get Copernicus back on line." Unsteadily, he keyed in the mikes, and spoke his identification, following it with: "We have a visual."

"We copy, SP-2 double A. We have your current velocity at 5.3 kilometers per second. Distance from the object 2.67 thousand kilometers. Do you copy that?"

"Affirmative, Copernicus," Melendez said after a glance at his readouts. "Do you suggest deceleration and manual control at this time?"

"Affirmative. Cameras on, now. We want to *see* that thing."

"I'm switching to VOR transmission immediately."

The instructions were quickly punched into the instruments. In addition to the omnifrequency scanners, sensors, spectrometers, and other analyzing instruments, three high-resolution Hitachi-Kodak VOR cameras zoom-focused on the object. One camera transmitted crystal-clear images in the visible spectrum, while the others produced infrared and ultraviolet images.

"All right, SP-2 double A. We have a signal. Good hard line. Continue to monitor your telemetry and approach the object on manual."

"Switching," said Melendez as he nodded to O'Hara, who punched out the autoguidance and assumed control of the small ship.

"SP-2 double A standing by," he said, then keyed out the throat mikes. The cylinder was already much larger,

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he noticed. Its dimensions were staggering . . . and they still had more than a thousand kilometers to go! "How's it going?" he asked O'Hara.

"Fine." O'Hara did not look at him, but continued staring at the cylinder which floated silently ahead of them.

It *was* hard to keep your gaze away from the object. Now that its shape was clearly discernible, it was obvious that it was no natural formation—asteroid, meteor, or even a monstrous chunk of frozen water or gases. A perfect cylinder—hundreds of times larger than the tallest building. Impossibly large, thought Melendez, yet there it was, filling up the viewport with its bulk. The thought kept hitting him over and over: something this large, so cleanly devised, had to have been designed. *Created.*

The notion could hardly mesh with his acceptance, and yet before him was all the evidence he needed.

"Oh, Jesus, I don't believe it. I *don't* believe it," said O'Hara, his voice soft, almost reverent. "What the hell *is* it, Melendez?"

"I think you know about as much as I do, O'Hara." A shiver of awe ran down his spine.

The VOR transmissions burst upon the Communications Center screens. Phineas Kemp and the Staff members stared at the images silently, unable to speak. Growing larger, clearer with each second, the representation on the computer-enhanced screens was obviously of an intelligently conceived and constructed object. Kemp could see the first details and markings along the dull, metallic surface. One end of the cylinder was flat and almost featureless, but the opposite end, when it tumbled past the camera's field, revealed large conical things, superstructure and tank-like formations. *Engines.* Engines capable of propelling the monstrous ship across impossible distances among the stars. No other alternative. The ship was not of Earth's stellar system—humankind had already established that humans were alone in Sol's collection of planets.

"It *is* a ship," whispered Marcia Bertholde, actually beginning to look every bit of her forty-nine years. Smoke drifted up from her cigarette, coiling like DNA molecules near her face.

Kemp nodded. "Yes."

Rheinhardt's aging, wrinkled face looked grim instead of wonderstruck. "If you laid it on its side it would stretch from Washington to Manhattan."

Kolenkhov shifted his ample girth uneasily in his seat, hands clasping together as though around a wished-for drink. "What are you going to have those two men do, Phineas?" he asked. "It might be dangerous."

"Observatory data indicates that the object has been locked into that cometary orbit for a long time. The orbit is *very* stable, and the period is precise. Aside from an undifferentiated electromagnetic field—which the Snipe's instruments are picking up *here*"—Kemp pointed to a column of readouts on one of the console's screens—"the object seems to be dead in space, although the scanners indicate a precise axial spin. Probably for artificial gravity inside."

"A derelict?" asked Rheinhardt.

"I don't know," Kemp said slowly. "All I'm saying is that it *appears* to be a derelict. It could have been orbiting the sun for God knows how long."

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"Is it safe for those men?"

Kemp looked back at Marcia Bertholde. "*Safe?* How should *I* know? We're in a hostile environment, Marcia. What the hell is 'safe' out here?"

He sighed. "Listen everybody. I don't know what we're dealing with any more than the rest of you. All I know is that we have a chance for an extreme close-up recon of something that appears to be an extraterrestrial object. A *ship*. And we can get a first-hand look at it! I intend to *get* it! If anybody has any objections, I want to hear them. *Now.*"

No one spoke.

The Snipe had come so close to the object that its viewing ports were totally filled with the greyish-silver expanse of its hull. The stars and the darkness had been matted out. Effectively removed from reality. It was as though the Snipe were preparing to land on a planet.

"Let's get the hell out of here!" said O'Hara. "We got their pictures . . . let's scram."

"I have to call Copernicus first."

"Jeez, I could use a friggin' drink. . . ."

"I could too, Chuck. I could too." Melendez patched in Moonbase Communications and voiced the proper contact words.

"We copy. Your telemetry is excellent. We estimate distance at one-forty kilometers. Put in for a matching orbit. I want recon within 500 meters of the surface, relative velocity less than 100 kilometers an hour. Can you handle that?"

"We'll try, Copernicus."

"Good luck."

"Onboard computer has matched-orbit coordinates, Copernicus. Stand by . . . matching orbits." At that moment, the controls were momentarily removed from O'Hara as the autoguidance speeded the vessel to obey the orders.

"Continue close approach to 500 meters. Surface-scan velocity 100 kph," Colonel Kemp's voice spoke in Melendez's headphones. The thought of coming that close to the immense ship threatened to unnerve him. He concentrated on his instruments.

"Affirmative, Copernicus. Match-orbit velocity in five seconds. Stand by."

O'Hara switched off his mike. "Crazy! Friggin' crazy!"

Melendez tried to wave him off, then switched off his mike. "Look, you will keep an eye on the controls, goddammit."

"Listen, Melendez, if there's anybody *inside* that thing, they might not like the idea of us pokin' around out here."

Calming his voice, Melendez said, "Think for a minute, will you? Anybody that is capable of building something like this ship, or whatever it is, doesn't have to be afraid of us. They've probably been aware of *us* a lot longer than we've been aware of them."

"Then how come they haven't sent out no welcomin' committee?" O'Hara's eyes widened. His forehead glistened with sweat. "How come!"

"I don't know," Melendez responded. "Look at the size of the damned thing! I mean, maybe we're so insignificant to them that they don't

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even care. We're like a little bug crawling along the side of a skyscraper."

The helmet-phones crackled. "SP-2 double A, what's going on up there? Everything all right?"

Back to Priority Channel. "Affirmative, Colonel. We have achieved match orbit, and will be assuming manual control. Altitude twelve hundred meters and closing."

"Roger, SP-2 double A. At 500 meters, begin recon toward the closest end of the cylinder."

"Altitude 700 meters and closing, stand by . . ." said Melendez, gazing over at O'Hara, who was nervously controlling the descent of the Snipe. The big man's face was flushed. He was covered with perspiration. His hands trembled slightly.

"Copernicus, we have reached altitude. Close-approach recon beginning now. Instruments are tracking. We have a positive make on all systems. Do you copy?"

"Affirmative. Make your first pass along length."

"Roger, Copernicus. Please stand by." Melendez swallowed with difficulty as he watched the metallic grey expanse of the object sweep past their view ports. An endless stretch of metal, so smooth it could have been polished on a jeweler's wheel. Occasionally the featureless, alien plain was broken by an unidentifiable contour—a housing, a small dome, a piece of superstructure that could be an antennae system, or perhaps even a weapons system. There was no way of knowing.

O'Hara was handling the controls as though in a trance. His eyes stared straight ahead, out at the surface of the vessel. It loomed so close it looked as though one could reach out and touch it. He thought that he might be able to do something to assure O'Hara that they were not in any danger.

"Copernicus, this is Spec-5 Melendez. I was wondering if I might ask you a fairly important qustion? Important to us, especially."

"Colonel Kemp here. Go ahead, Melendez."

Melendez smiled slightly. He'd long ago discovered that the best way to handle a problem was to attack it straight on. Ask the right questions; get familiar with the authority figures; don't be afraid. He'd ask what he wanted to know, not caring about the responses he might get as much as his ability to establish a position for himself.

"Thank you, sir," Melendez said. "You see, my partner and I have been wondering just *what* it is we're scanning. I mean, does Copernicus have any idea? Have you made contact with it?"

"Negative, Melendez. We don't know any more than you. Attempts to communicate with the object on every conceivable band and frequency have been made. All negative. The only signal we detect is a general field display, which indicates some kind of internal activity. We don't know what kind of activity, and we were hoping that you might be able to help us find out. Continue lateral scan, Melendez. We will forward further instructions as necessary. Standing by."

O'Hara pulled his throat mike off and cast it across the console. "They don't care about us!" He continued to stare straight ahead, rocking in his seat, whis-

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pering softly to himself. "Christamighty, O Christamighty!"

Poor guy, thought Melendez as he assumed control of the Snipe as well as the instrument monitors. The thought struck him that O'Hara might try something crazy, and he doubted if he had the physical strength to restrain him.

He shook the notion from his mind, checked his instruments, and concentrated on the object. Its surface seemed more cluttered now, as the Snipe edged along its length, away from the bow. Configurations and shapes were scattered across the expansive hull, which Peter noticed was turning slowly on its longitudinal axis. He considered reporting this to Copernicus Base, but realized that the scanners would have long ago relayed this movement back to the moon. The rotation did indicate something: the instigation of an artificial gravity *within* the vessel by centrifugal force.

An old idea, but a sensible one, included in the original colony designs of O'Neill back in the last century. This concept made especial sense, considering the fact it was alien. The inhabitants might require a gravity-dominated environment so that they might endure the long spans of time needed for interstellar flight.

An alien ship. The phrase resonated in his mind. Hard to accept. It stretched his mind to the point of snapping. He could almost understand why O'Hara was tottering on the point of hysteria.

As the Snipe continued its longitudinal course, Melendez noticed a general increase in the complexity of superstructure on the hull. Small hexagons seemed to be placed in clusters of six at regular intervals. Antennae and other unclassifiable projections sprouted in abundance.

"SP-2 double A, this is Copernicus. Accelerate to 500 klicks a second and continue longitudinal course. We want to get a look at the aft section. . . . Do you copy?"

"Copy!"

The Snipe lurched forward under the power from the ship's thrusters, and the landscape of the hull glided by quickly. Melendez guided the ship silently towards the opposite end of the great cylinder. As the Snipe drifted past the end of the cylinder, he felt an instant of vertiginous fear. The maneuver was not unlike driving a car off the edge of the Grand Canyon.

"Copernicus, this is SP-2 double A. UCR should be giving you pictures of what looks to be the business end of this thing. I'm plotting a transectional course across the diameter. Do you copy?"

"We copy, SP-2 double A. Continue on changed course. We *are* standing by . . ."

Melendez checked his instruments; they stared down at the gigantic funnel-shaped structures which passed beneath the Snipe. They were engines. Immense engines. Literally hundreds of the inverted cones were grouped in clusters of ten. The dimensions were deceiving, for although they looked small in comparison to the bulk of the ship itself, Peter knew that even one of the cones, placed next to the Texas Triangle towers, would make those buildings look like a stack of children's building blocks. He wondered what energies had flowed from these great engines, what kind of force had once collected here.

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O'Hara had calmed down considerably. His lips were moving, but he made no sounds, and the rocking motions had slowed to almost nothing. "How you doing, Chuck?"

O'Hara looked at him, but said nothing for a moment. His eyes were blank and lifeless. "Just get me outta here."

There was nothing to say to that.

As the Snipe reached the end of the transect across the cylinder's diameter, Melendez radioed in for further instructions, which called for another longitudinal scan. Keying in the maneuvers, he guided the little ship past the edge and into position. The delicate fire of the retrorockets responded as Melendez played his control console like a musical instrument.

Some people thrived on moments like these. Others collapsed under the pressure. Phineas Kemp knew there had already been a surfeit of make-or-break moments in his own career . . . and yet, here was another one lying heavy on him. He looked carefully into the faces of the Staff Chiefs, hoping to find an answer, finding nothing.

What should be done?

"Gregor," he said softly. "How long before we can get a reliable analysis of this data?" Kemp waved an arm at the display screens.

The Russian shrugged noncommittally. Gregor was a good friend. A large, going-to-fat man, he obviously enjoyed the pleasures of a "Western-oriented" style of living. Over the years he had acquired a taste for good California wines and straight poker. Smiles came easily to his Slavic features, but none were forthcoming now. "Not long. An hour or two, if we put enough good people on it."

"They'll all have to be cleared through Security," Rheinhardt reminded him sternly.

Kemp nodded. "Gregor, give him the names you want. Oscar, get those clearances immediately."

"And the men in the ship?" Marcia Bertholde said.

Kemp turned and faced her, retaining his stoical expression. She was a hard one, Marcia was, just waiting to get him through a chink in his armor. She was ruthless and ambitious. But she was also extremely efficient, almost indispensable, in her assigned duties.

"I haven't forgotten them, Marcia." He turned to Kolenkhov. "Gregor. I'd like to get a molecular sample from that thing's hull. What's the feasibility?"

"Shouldn't be a problem. The Snipe's grapples have metal samplers in their tool gauntlets. The miners take rock samples with them all the time."

"Right. We'll give it a try and then get those fellows back to the *Astaroth*." He leaned over the communications control. Switched it on. Spoke.

Melendez jumped as Colonel Kemp's voice cut through the cabin's silence. He responded immediately.

Kemp continued. "Listen, Melendez, we have one final task before breaking match-orbit. It's been suggested that you can use the soil-samplers on your ship's grapples to get us a molecular sample of the object's hull. You'll have to key-in a match for the object's axial rotation. Can you do it?"

Eager to please, Melendez spoke without pausing to consider any possible

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danger in the request. "Affirmative, Copernicus. Onboard has necessary matching capability. Not too different from attaching to a spinning asteroid. We've put down on rocks with worse rotations that this."

"We copy, SP-2 double A. Proceed on longitudinal course beyond the aft-end superstructure. Select a suitable touchdown by visual. We will monitor via VOR. Good luck. Copernicus standing by."

O'Hara continued to stare out the viewport, mumbling to himself. Probably better this way. If the big man realized what was coming next, he might short-circuit.

Checking his boards, Melendez began to decelerate, then keyed in a matched orbit request based on the Euler spin parameters of the object. The ship's small computer responded immediately as the durations and designates for thruster-fire appeared on the display screen. Melendez had a moment now to reflect on this final phase of the mission. He kept wondering about *who* might be inside that giant ship . . . and how they might feel about Earthmen pouncing on their outer hull and scraping around. A little close-up snooping was one thing. But actually touching down. . . ? That might not be such a good idea.

On the other hand, here was his chance for real achievement. Physical contact with an alien ship. The dream of adventure he'd had for space was now being realized. He'd be a hero.

He could go back and face Caroline now, with a solid and substantial reason for leaving Earth. Maybe she'd understand after this. . . .

The display screen stabilized, the onboard ready for the complex maneuver which would bring the Snipe down.

"Ready for touchdown," he said.

"We copy. Proceed with caution."

Punching in the instructions, Melendez watched the hull configuration grow larger as the tiny Snipe began its descent. He could see patterns in the collection of hexagon shapes, noted the formations of dome-like blisters spaced evenly across the hull. He saw seams in the metallic surface which might be hatches, and thought of radioing in his observations, before he realized that the Copernicus staff was seeing it as well.

"Altitude 100 meters and closing."

The Snipe attained the angular rate coordinates and was now descending at a 62-degree angle. A large expanse of hull stretched out ahead of the ship's flight path. Melendez assumed it would be a good touch-down site.

"I'm within 50 meters of the surface, Copernicus. Do you suggest a hover-attitude or complete touchdown? The grapple has a 5-meter range."

"Attempt complete touchdown. We want to be sure of the sample."

"Roger. Eighteen meters and descending."

O'Hara grabbed his shoulder. "Get us outta here, kid. They're gonna kill us."

Ignoring him, Melendez watched the hull of the giant ship rise up to meet them. He could see that its metallic surface was burnished or perhaps scored from the abrasions of countless particles and micro-meteorites. How long had this thing been drifting through space?

As the Snipe approached a flat area, Melendez noted movement on the hull.

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"Copernicus. Something's moving down there. One of those little domes. Peeling back . . . "

There was a pause. Then: "We have it on the VOR. Cancel touchdown. Repeat, cancel touchdown and get out of there."

As Melendez reached for the proper key on his control panel, a brief burst of light flashed beyond the view-port.

The blister on the alien ship's hull had disappeared, replaced by an array of parabolic dishes, which immediately converged their beams to intersect with the oncoming Snipe.

The beams of intense energy from the array wrapped the prospecting ship in a ring of dancing fire. The heat of contact *vaporized the outer hull instantly*. Decompression blew out Melendez's ears before he could even scream.

The explosion swept him into blindness, then nothingness.

In the black silence of space, there remained a small cloud of debris. Metal fragments. Ash-like swirls of particles. The cloud retained a vague orbit around the gigantic vessel, dissipating gradually into space.

CHAPTER FOUR

MINUTES FROM IASA JOINT CHIEFS OF STAFF MEETING, August 15, 2027
(Partial) SUBJECT: ARTIFACT ONE
CLASSIFIED. TOP SECRET.
FOR GOVERNMENTAL EXECUTIVE USE ONLY.
(Excerpt) FAX SHEET SUPPLIED BY DR. ANDRE LABATE.

RELEVANT INFORMATION

Semi-major axis of orbit: 35.33 Astronomical Units. (highly eccentric, perihelion 24 million kilometers)
Orbital period: 210 years
Stability of Orbit: unknown, although backward integrations for a hundred-thousand years suggest very high stability.
Axial Rotation Period: 360 seconds
Electromagnetic Activity: undifferentiated.

First Order of Business: Colonel Phineas Kemp exonerated from blame for deaths of Miners Charles O'Hara and Peter Melendez. General agreement that Snipe destroyed by automatic, unmanned defense system *accidently triggered. Still no* response from within object. (Code name, Artifact One)

Second Order of Business: Discussion of security measures (see attached complete report from Security Chief Oscar Rheinhardt)

Third Order of Business: Announcement of plans to intercept Artifact One with a Deep Space Probeship as soon as possible. Crew of eight to be launched within thirty-six hours, with three objectives:

1. Neutralize defensive systems of *Artifact One*.
2. Gain access to ship's interior.
3. Analyze and determine feasibility of attaching continuous impulse engines to craft, to guide it back to a geo-lunar synchronous orbit for further intensive study.

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Fourth Order of Business: Selection of crew complement. Duties and suitable individuals selected.
Mission Command Pilot: Douglas Fratz, Lt. Colonel, IASA
Back-up astrophysicist and navigations specialist: Michael Bracken, Lt. Captain, IASA
Tactical Engineer: Ian Coopersmith, Captain, IASA
Assistant Tact. Eng: Thomas Valdone, Lt. IASA
Weapons Specialist: Dr. Gerald Pohl, US Army
Exobiologist: Dr. Amos Hagar, civilian
Communications Officer: Alan Huff, Lt. IASA
Bio-Med Specialist: Dr. Rebecca Thalberg, IASA.

"No," said Kemp, "I won't have it!"

"You were outvoted, dear love," said Becky, smugly walking ahead of him. She had to go back to her apartment to get ready for the trip, then to her laboratory to select the equipment she needed. She could use this spot of adventure. Get away from the drab, sterile Copernicus hallways like the one she walked in now. Get away from Phineas Kemp, and at the same time *prove* herself to him. Clearly that was what was necessary in this war of love in which they were involved. She couldn't convince him to play her way, with warmth and vulnerability, intimacy and sharing. She had to show him that she was his equal in the things that counted to Phineas Kemp, namely ambition, strength of will, and accomplishment.

Kemp grabbed her arm. "Wait. Will you talk for one minute? There's still time to change your mind."

He swung her around to face him. "I'm going, Phineas, and there's nothing that you can do to stop me! I'm the best-suited person on the Moon for that position. And I want it!"

She paused for a moment, a bit surprised at Kemp's expression. It wasn't stern or demanding. It was actually soft, almost pleading. Since those poor miners had been killed, he'd been like a rock. Hardly a word from him. He hadn't *touched* her, and he'd repulsed any efforts she'd made to comfort him, damn him. He didn't seem to care much that two lives had been lost—only that his plans had been fouled. Becky could understand his preoccupation. What she couldn't understand was why it seemed to obsess his every waking and sleeping moment, and why he wouldn't let her share some of the burden. He was a self-sufficient bastard, and he'd rather die than show *anyone* that he felt human emotions in time of military stress. Even his lover.

Now, though, there was something like hurt in his attitude. Hurt—and extreme worry. "Look, Becky. I love you. This has been rough for me. If I had to fret about your safety . . . I mean this could be a *very* dangerous mission and—" She was astonished. She swept back her hair and stared straight at him disbelievingly. Was he actually showing honest emotion? Had she managed to tug it out of him? ". . . and if I'm thinking about your welfare all the time . . ." He glanced away from her. "Well, I just couldn't be able to fulfill my duties here at Copernicus properly. I—"

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She blinked and dropped her mouth a bit with vexation. Then she spun about and began walking again, faster this time.

He was in excellent physical condition, and it only took a moment for him to catch up with her. "Hey! What did I say?"

"Phineas, I accept the fact that you care more about this blasted job of yours than you care about me. Just don't shove it in my face. You won't have to worry about me." She turned on him quickly, frowning. "I'll just make sure I don't make the mistake of that Snipe crew and follow the more stupid of your orders. My number *one* exercise of that resolution will be to ignore your demand that I don't go on the mission."

He cringed a bit, as though physically slapped. Stunned, he took a step back. Then his face hardened, his neck muscles tensed. "Very well, Becky. I—I'm sorry to try and persuade you against doing what you want. I'll see you before you leave." He turned around and began to walk away. "Maybe."

"Phineas. I didn't mean to phrase it that way."

He ignored her, and continued walking, his footsteps echoing softly in the corridor.

Becky sighed. Men! They refuse to open up, and when you desperately try to get some emotion out of them with a jab, they reel and they run away from you! Why the hell had she gotten involved with Phineas Kemp, surely one of the worst of the lot! For two years she'd been seeing him, and it had always been this way, never improving. Why? *Why* did she put up with it? Because he was handsome and strong? He was that, certainly. Something melted inside of her when she looked at him. Because he was good in bed? Yes, that too. The best she'd had as far as endurance and technique went. Because he reminded her of her father? Very much so. And at least Phineas never slapped her around.

All that and because she respected him for his competence. Trusted him. He never lied. Maybe it was because he lacked the imagination, but still it was a sight better than a lot of men she had known whose egos and relationships were propped upon an elaborate structure of dissembling and self-delusion. But above all, there was a part of her that helplessly *surrendered* to him, immersed itself deeply in his being when he was around. It was deep and it was love, no question. He said he loved her too, and perhaps he did in his way. But he refused to surrender to her, give himself to her as she did to him.

So, she figured if she gave him a taste of his own medicine, showed him she was fully as competent as he, *competed* with him (oh, how he relished competition) they might at least be able to begin to discuss things on equal terms. God, how condescending he was sometimes. . . .

Oh, dammit! Don't even think about the self-righteous jerk, Becky told herself. Do what you want to do, she thought as she reached the lift which would take her to her apartment.

She *did* want to go on the mission, and not only to prove herself. Indeed, she felt a sense of awe about the thing. As a specialist in biology and space medicine, extraterrestial life had always been one of her consuming interests. To

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think that she going to have the opportunity to actually examine evidence of it!

She concentrated on this as she entered the lift, struggling very hard not to think of Colonel Phineas Kemp.

CHAPTER FIVE

It took all of Ian Coopersmith's professional training to stay calm, to continue concentrating on the problem before him and not the immensity and majesty of the thing called *Artifact One*. There it was now in the view-screen, lending part of its reflected light to the dimness of the IASA *Heinlein*'s control room. Scattered about him, either in their flight positions or simply strapped down to observe, were the other members of the expedition, the lights from the screen and the control boards playing over their intent features in odd patterns. He'd come to know them all in the days of the journey. Travelling in space tended to do that with a group. You learned your insignificance real quick against the backdrop of the universe, and you let down more of your defensive barriers to others, if only for the company that was so vital.

Coopersmith stared down again at his operations panel, wanting to check his figures again, but knowing they were right. A trace of the old neuroticism again, huh chappie? he asked himself.

In this situation who could blame him?

Lieutenant Huff leaned over and said in his usual mild voice, "Channel clear, sir."

"Right. Thanks." Coopersmith cleared his voice, and snapped on his headphone mike. "Copernicus Base. This is the *Heinlein*. Coopersmith here."

He glanced over his shoulders and gave a wink of reassurance to the others. That was important at this point, and Coopersmith tried to maintain a spirit of *bonhomie* with everyone to try and relax them. They all remained expressionless, except for two of them. Dr. Hagar was frowning with intense concentration, as though it was his willpower alone that made this expedition possible. He'd almost said as much once, allowing that if it weren't for his efforts among the public in the past years, the space program might be extremely curtailed at this point. The bounds of the man's egotism never failed to astound Coopersmith. He studied science the way a person obsessed with genealogy might study his family tree, and with the assumption that he was indeed at the uppermost branches of intelligent development. Dr. Thalberg smiled pleasantly at him, which was a welcome relief. He could use *that* kind of space medicine anytime. He liked Rebecca, and despite himself sometimes wondered what her bedside manner was like.

"Affirmative, *Heinlein*," came a voice, deep and crackling, from the speaker grille. "What is it, Captain?"

"We are prepared to start the disarming operation. Request check on telemetered data. Do you get a good *make* on the visual?"

"One moment, *Heinlein*."

Coopersmith waited along with the others in silence.

Waiting, thought Coopersmith. There was a lot of that in deep space.

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They'd waited awhile to get here. The IASA Planetary Probeship *Heinlein* had hurtled through the light-shot darkness of space on a course here that formed a great quasilinear trajectory. Powered by high-thrust, continuous-impulse Lukodyanov engines, the ship had made a continuous thrust hyperbolic transfer to rendevous.

The *Heinlein,* by IASA standards, was a moderately large ship—more than 100 meters in length. Since it was a deep space vessel which would never fly in any planet's atmosphere, no thought had been given to aerodynamic design. The control section, located at the bow, resembled the head of a mako shark, but without the smoothed edges. Below the forward viewport yawned a large ramscoop, which enforced the shark image. Trailing off behind the control section was a thinner, rectilinear fuselage which contained fuel cells, crew quarters, equipment holds, launch bays for planetary probes and lander, life-support modules, and finally the energy converters. Beyond the fuselage, at the aft end, were the engines—large conical funnels in four groups of three. All along the hull, ungainly superstructure dishes and radio-receiving parabolas were placed. In terms of sophistication, the *Heinlein* made the old LEM Modules of the first Moon landings look like the Wright Brothers's gas-powered kite.

As grand a vessel as the *Heinlein* was, it was dwarfed into insignificance alongside the alien cylinder. So immense was *Artifact One,* that if viewed from a distance, the *Heinlein* alongside appeared no larger than a dust-mote trying to attach itself to the alien hull.

As they waited, Commander Douglas Fratz just gazed at the ship, shaking his head slowly. "My God, those engines. Can you imagine the *thrust* they must have in them?" His voice was surprisingly soft for his build, which was large and muscular. He wore his reddish-blonde hair long, although it was beginning to thin at an early age. He sported a neatly trimmed beard that looked like a chin strap to hold on his hair. He'd accompanied Colonel Phineas Kemp on the first manned probe to Pluto, earning a commendation for his service during the long arduous journey.

"I think what interests IASA most," said Coopersmith, "is the drive."

"Hmm?" returned Fratz.

"Drive!" Hagar said, like a teacher talking to a small child. "Interstellar drive! By what method did this ship get here? Obviously, the intelligence that constructed this was also able to figure out how to cheat the speed-of-light barrier. If we get hold of that—" His voice was excited. "The universe will open up to us. Mankind will spread to distant planets, as we were meant to. A glorious dream, fulfilled."

"Yeah," said Fratz. "The glorious dream that I want to fulfill right now is to complete this mission and get out of here alive. You can spread your seed over the stars as much as you want, Hagar. I just want to keep my ass intact."

Coopersmith and Thalberg were the only ones to laugh at that. But inside, Coopersmith agreed entirely with the commander. He had a wife and a family who, he'd long since realized, were a lot more important to him than his job. Coopersmith was a tall, tightly constructed man of forty-two. His bronze/tan

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complexion was not born of sunbathing, but of his parentage. His father had been a British factory worker, and his mother a West Indies black who'd worked as a salesclerk in London. "*'You've more than a touch of the tarbrush in ye, Ian,'*" his father had once told him. "*Your mum and me dumped the whole bloody barrel on ye!*"

"Yes, well, that's what all of this preliminary stuff is about, isn't it, Commander," said Coopersmith.

Using the coordinates and telemetered data from the ill-fated Snipe, Captain Coopersmith had guided Fratz along the hull, delicately scanning the alien surface in search of anything that appered to resemble an entrance hatch, or perhaps a launch bay. After a careful survey of the ship's surface, several likely configurations were located, mapped, and more intensely studied.

If *Artifact One* possessed more than three hatchways, they were well hidden. Coopersmith would have preferred to enter at one of the ends, but no accessway was immediately apparent. There were, however, hatches in the middle of the cylinder, each of a different size.

An intense study of the device which destroyed the Snipe had advised the IASA to equip the *Heinlein* with a phased array of active screens which should effectively neutralize the amplified-light weapons of the alien ship. After an in-depth survey, Captain Coopersmith selected the best landing and entrance site for the *Heinlein's* lander module. The first step, however, was to effectively disarm the geometrically placed blisters which covered the hull in a consistent pattern.

Coopersmith and his assistant Thomas Valdone had assumed that the defensive blisters were arranged in the observed pattern because each had limited range. To test this theory, dummy probes —small gas-powered rockets—were directed towards the hull. Within 20 meters, a tight beam of light flicked out from the closest blisters. End of rockets. Coopersmith's theory seemed to test true. And so he devised a battery of small, shaped thermonuclear warheads with controlled explosive characteristics, protected by energy screens. By computer guidance, each warhead was directed to each defensive blister within range of the entrance hatch he had previously selected. The controlled explosions should, theoretically, eliminate the defensive blisters without causing more than superficial damage to the alien ship's hull itself, thereby providing a safe work-corridor for the landing module and the EVA team which would be working to open the hatch.

A risky operation though, this, mused Ian Coopersmith. Although all available data indicated that the alien ship was dead in space, and had been so an indefinite amount of time, there was no guarantee that an extraterrestrial intelligence was not observing them and would interpret the shaped-charge explosions as acts of aggression.

Colonel Kemp had pointed out, though, that there had been no response from the alien vessel to any human communications attempts. There was no alternative but to attempt entrance by force. Quite simply, it was a risk which had to be taken.

The warheads were armed. All that was necessary now was word from Copernicus Base.

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It arrived.

"Affirmative, Captain. Colonel Kemp's given the go-ahead. Any time you guys are ready."

"Launching warheads now. Stand by, Copernicus . . ."

Coopersmith nodded to Commander Fratz, who keyed in the launch order to the *Heinlein*'s onboard computer. The hull shuddered slightly as the warheads were launched. Instantly, tracking instruments displayed their data on the console screens. Small, three-dimensional blips closed in on a schematic representation of the targets. No one spoke save for Coopersmith, who reported the closing distances in a half-whisper: "Trajectories are on-line . . . closing nicely . . . 20 meters and closing . . . 10 . . . we have detonation!"

In the vacuum of space, the explosions on the surface of the alien ship transmitted no sound. They looked like brilliant crimson buds suddenly blossoming. The display grids of the console flickered as the sensors collected new information. Coopersmith could see that the first phase of the operation had been successful. The controlled explosions had obliterated the defensive blisters without seriously affecting the alien's hull.

"Copernicus, this is Coopersmith. So far, so good. Scanners indicate no loss of pressure on *Artifact One*. We are launching a dummy probe. Stand by."

Fratz waited for Coopersmith's nod, then keyed in the launch. Heads turned to watch as the small torpedo-shaped probe, equipped with shock-absorbing landing legs, slowly descended toward the surface of the alien ship. No one spoke as it closed within range of the defensive systems. Closer and closer it descended until its automatic devices fired off a short burst of retro fire and the probe settled gently upon the surface, holding fast with magnetic seals.

"Copernicus, we have a touchdown!" cried Coopersmith, exultant.

"Affirmative, Captain. Congratulations," returned the communications man from Copernicus.

The crew cheered, and Coopersmith swept off his communications helmet, and turned blue eyes upon the company.

"I do believe that we're next!" he said.

Ian Coopersmith kept his thick, dark hair cut short for moments such as these. Long hair could be rather a problem sometimes in an EVA suit. Coopersmith tried to keep his problems down to bare minimum at all times.

"Ready, Valdone?"

The dark Italian turned amused eyes and Sicilian nose toward Coopersmith. "I've been ready for this for a long time, Captain."

Coopersmith gave him a thumbs-up signal. They donned their helmets and switched on the life-support equipment.

After a quick jump through the airlock of the *Heinlein*'s No. 1 Lander, which had drifted down from the Probeship and effected a perfect landing near the outlines of what appeared to be an entrance bay, they floated cautiously down to the hull.

Led by Coopersmith, they walked across the surface of the alien ship, placing their magnetic boots carefully. The lander—which looked to Ian rather like

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an overfed tarantula—waited patiently behind them.

A historic occasion, thought Coopersmith. Yes, indeed. Man's first physical contact with an extraterrestrial craft. But there was no trumpeting fanfare, no live TV coverage to Earth's billions, no eloquently rigged speeches for the history books. There would be time for such things later, maybe. History books were not on Coopersmith's mind as he appraised the contours of the apparent hatch below their feet.

The outlining seam of the hatch was quite large: approximately 10 meters wide and 15 high. Several small rectangles that measured slightly more than two meters each were on each side of the hatch. Their function or relationship to the larger, seamed configuration was not clear. Coopersmith used a sensory instrument which resembled an X-ray machine or fluoroscope. A Mark 8 Betatron Scanner, which allowed the user to view the interior of metallic objects of varying degrees of density and opacity.

Incredible, thought Coopersmith. An airlock quite comparable to IASA design.

Although he and Valdone weren't able to determine how to operate the entrance electronically, the scanner did allow them access to the mechanical system of the lock. By cutting through the hull with laser-torches at the control-point, they were able to open and close the outer hatch manually. The entire procedure took five hours. Best to work slowly and cautiously, Coopersmith reasoned. Each step in the operation was being fed back to Phineas Kemp at Copernicus for verification.

At last, the large hatch slid open to the right, revealing a flat, featureless platform. Coopersmith entered a chamber which was roughly a cubic fifteen meters. The metallic walls had a slightly burnt-blue cast, and were buttressed by support girders. At the opposite end of the chamber, Coopersmith could see the outline of another hatch. Presumably, the other end of the airlock. At a height of approximately five meters, next to the hatch, were a set of three levers, inset in a meter-square shadow-box. Coopersmith assumed these to be controls which operated the interlocking set of hatches.

Floating up to inspect the controls, he wondered why they were so inaccessible. The logical explanation was obvious. The aliens who built this ship were at least several times larger in scale than humans. The thought was an unsettling one. Coopersmith did not dwell on it. He concentrated instead on the immediate task.

"Copernicus, this is Lander One," he said in his British accent. "Coopersmith here. We have successfully entered what appears to be a standard airlock chamber. The operation of them seems possible. We're going to try some experimenting. Stand by, please."

"Affirmative, Lander One. Proceed with caution." Colonel Kemp had taken over the communications. The man was probably tense as a coiled spring by now. His voice sounded small and very far away.

Coopersmith indicated to Valdone that he was about to touch the controls. "Right, Valdone. Get back out on the hull by the lander. Tell Bracken to be

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prepared to lift off if we have any trouble."

Valdone signaled agreement and floated slowly from the airlock, positioning himself on the hull near Lander One. The faraway sun glinted off his faceplate as he stared in at Coopersmith.

Exhaling slowly, Ian Coopersmith studied the three levers, each as large as a cricket bat. They were color-coded. Red. Yellow. Green. God, thought Coopersmith. There was no way that the alien color system meant the same as the human code. He followed that assumption and tripped the red lever.

Nothing happened.

Coopersmith reached for the next lever. "Negative on the first control, Copernicus. Trying number two, here . . ."

Slowly, soundlessly the outer hatch slid shut.

"That's got it, Captain," said Valdone, floating by the outer hatch, watching it seal Ian off from the outside.

"All right," said Ian. "Let's try it backwards. And make sure I'm not sealed in here permanently."

He pushed the lever back to its original position and the hatch began opening again. "Bull's eye!" said Valdone. "Looks like we're in business."

"Okay," said Coopersmith. "I'm closing it down. Valdone, come inside. Let's see if we can get the other hatch to work."

He threw the yellow lever and again closed the outer hatch. Trying the green control resulted in no immediate change. Slowly, though, the sound of gases rushing into the chamber became audible.

"Copernicus, this is Coopersmith. I'm getting what appears to be pressurization of the first chamber. Stand by."

Less than a minute passed before an electronic chime sounded in the chamber. Coopersmith presumed it to be a signal indicating the proper pressure.

"Captain, we've got an atmosphere in here. Want to run an analysis?" Valdone drifted down to the deck, where they had secured their instrument packs.

"Right, Tom. I'll notify Copernicus." He switched over to the patch-in with the lunar base once again. "Colonel, we've got an atmosphere in the lock. Valdone's running a check on the make-up now. Plase stand by."

"Hey. Now that's really something. Listen to this, Captain. Nitrogen, oxygen, carbon dioxide, trace argon, and a little water vapor. Pressure about 1000 millibars! That's incredible."

"Ah, Copernicus. This is Coopersmith. Atmospheric analysis indicates nearly Earth standard mix. Breathable for us, anyway. Pressure is close to sea-level averages. Temperature approximately 15° Centigrade."

"We copy that, Coopersmith. Exact data will come in from telemetry. Proceed with entry operation." Jesus! He'd expected an *alien* atmosphere.

"Roger, Copernicus. Stand by." Coopersmith shut down the radio link and stared for a moment at the control panel and the large hatch. Thoughts which he had been able to keep from his mind would not leave him now. The full impact of where he was and what he was doing suddenly struck him.

Staring at the blank hatch, Coopersmith's mind *unhinged* for a brief moment. He saw visions of strange beings standing on the other side of the en-

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trance, waiting to greet the naive Earth folk who had bumbled into their ship like moths into a spider's web. He thought of London's East Acton, where his modest rowhouse lay jammed in with a thousand others like itself, where his wife Leticia and his son, Nathaniel, lived and worked, knowing that they would only know his company in six-month chunks of time.

Suddenly, Coopersmith was aware of movement to his left. Turning quickly, he saw Thomas Valdone beside him, staring at him. "You okay, Captain?"

"Yes . . . yes, fine. I was . . . just thinking about something."

Valdone smiled. "Yeah. I know what you mean." The engineer looked at the flat, imposing surface of the hatch. "I'm pretty scared too. I . . . I don't know, Captain. I've grown up loving the stars. And now . . . well, now all I want to do is go back home and be safe. Here, in the thick of excitement. Thomas Valdone! Privileged man! My old man . . . my old man is gonna be real proud of me. My momma too. My wife didn't want me to go. I kinda wish I'd listened to her." He sighed. "But still, Captain, if you . . . just let go, you know, accept all this immensity. You kind of lose yourself, and the fear ebbs a little. It becomes awe. Know what I mean?"

"Valdone. I wouldn't have any other man along with me."

"Thanks. Well, I guess we better give it a go, huh?"

Coopersmith turned and reached for the third lever, pulling it down. A low humming sounded as the inner lock door slid left. Both men stared into the darkness beyond as though peering into the mouth of some great beast. Valdone produced a powerful light torch from his utility pack and flicked it on. The broad beam of light pierced the blackness, revealing a four-sided corridor leading away, like a mine-shaft. No markings or features showed on the walls except for two parallel rods, attached at frequent intervals along the surface, that ran into the dark. Also spaced at regular intervals were small struts, protruding from the parallel rods. If you looked at it long enough, you could see that it was a multipurpose ladder, an aid to climbing "up" the long corridor.

Valdone grabbed the first rung.

"Wait a minute. Come on back. I'm going to depressurize and bring in some of the others."

As Valdone worked his way back into the airlock, Coopersmith reclosed the hatch with the now-familiar controls. As the outer hatch reopened, Ian turned to his assistant.

"You stay here. I'm going back in the lander with Bracken and assemble the others. It's time to get in there and see what makes this thing tick."

An hour later, the entire exploration team was assembled in the first chamber of the *Artifact One*'s airlock. Commander Fratz and Back-up Pilot Bracken remained at their stations aboard the *Heinlein* and Lander One respectively.

"Right, then," he told the group, after letting them ogle the airlock for a moment. "We've got something to breathe inside, believe it or not. Once we close the second lock, we can discard the EVA gear. However, I want everybody to wear LS-rigs in case of an emergency. Stay close together and

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keep your radios *on* at all times. Keep your side arms *in* your holsters. No one is to draw arms without my authorization. Clear?''

It seemed to be. Everybody agreed, either immersed in wonder or obviously touched with anxiety. ''Friends,'' he announced. ''I give you *Artifact One!*''

The proper levers were manipulated. The chamber pressurized. The inner lock opened. Lanced by the concentrated power of everyone's electric torches, the dark corridor appeared less forbidding, and much more like the functional access to the ship's interior it was.

One by one the members of the team entered the corridor, until the last, Doctor Pohl, a lanky, red-faced man, floated through. He gave the all clear. Coopersmith closed the interior hatch, instructing all to divest themselves of the cumbersome, deep-space environment suits.

Pulling off his helmet, Ian Coopersmith smelled the air. It had a cool, antiseptic quality which, while not offensive, seemed alien. Perhaps it was merely psycho-suggestion that gave it that scent. Still, it seemed odd.

He waited until everyone was ready. They all wore field jumpsuits, backpacks and emergency life-support modules strapped to their chests. The LS units had collapsible face-masks which could supply water and oxygen for several hours.

''Huff, patch me into the *Heinlein* link,'' Coopersmith said as he grabbed onto the ladder leading upward into the belly of the alien ship.

''You're on, Captain.''

''Copernicus, this is Coopersmith. We have entered the airlock assembly without a hitch. There appears to be an access corridor leading up into the main body of *Artifact One*. We're going up now. Stand by.''

After receiving the go-ahead from Kemp and his lunar team, Ian led the group upwards. The scraping of their boots on the metallic rungs and their labored breathing penetrated the surrounding hollow silence. The corridor, under the influence of *Artifact One*'s artificial gravity, appeared to be going straight ''up''—actually toward the geometric center of the cylinder. The distance they travelled was approximately 100 meters, ending on a 10-by-10 meter platform fronting another entry hatch directly above their heads.

When everyone had gathered on the platform, Coopersmith relayed their progress and position back to Copernicus. Receiving another go-ahead, he ordered Huff and Valdone to open the hatch manually by means of two interlocking gear-wheels. The sound of metal, moving smoothly, filled the chamber. Instead of sliding into the bulkhead, like the previous ones, this hatch opened vertically. As the hatch parted, a bright seam appeared, as if there was an intense light-source immediately beyond it.

Everyone tensed momentarily. The two men paused as Coopersmith held up a cautionary hand.

''Right,'' he said, climbing the short ladder leading to the hatch. ''Keep your sidearms ready, just in case there's an unfriendly reception committee. Not likely, that, but we'd best be ready for anything. I'm going in first. Then Valdone. If that goes well, Thalberg, Pohl,

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and Hagar follow, in *that* order. Huff, you bring up the rear and establish a homing beacon at this hatch just in case there's a maze of passageways. I want everybody to lock into the beacon. That way nobody gets lost. Also, Huff, I want you to maintain the link through the *Heinlein* back to Copernicus. Everybody got that?''

Coopersmith looked at the party. Pohl's mouth was ajar. He breathed heavily. Hagar's fingers twitched nervously. Huff was stolid and alert. Valdone licked his lips expectantly. Thalberg's eyes were wide and dark.

For the first time Coopersmith realized just how beautiful those eyes were as they looked up toward an unknown future.

He turned back to the hatch. ''Here we go.''

CHAPTER SIX

They stood upon a small rise of earth which overlooked a sloping meadowland. This faded away to a marshy swamp and, finally, a lagoon. To either side lay the edges of a dense, lushly green forest. Warm and muggy, the air was full of steaming, organic smells.

There was no horizon.

The tropical landscape of jungle forest, river and sea, stretched endlessly away until it *curved upward* and over them, filling the sky, *becoming* the sky, 65 kilometers distant, curving, curving back behind them in an endless roll. The entire interior of the gigantic cylinder ship was a living world of rich loamy soil, swamp, forest.

Yet, encapsulated as this world was, light streamed down from a brilliant source. It was so bright and intense that it hurt Coopersmith's eyes, as though he were staring at the sun. Quickly, he flipped down the sun-shield goggles in his LS helmet.

Running the entire 320-kilometer length of the cylinder, hanging almost magically in the zero-gravity center of the rotating world, burned a thick rod, a seemingly solid column of light and heat which filled the world with artificial day.

A feeling resembling *déjà vu* swept Coopersmith. He'd dreamed of standing in a place like this, and yet his vision had been that instilled in him by the dreamers who planned a space colony fitting this concept on a much smaller scale, filled with cities and parks, not wilderness. This was *alien*. And it was *huge*. Seeing it from the inside made him realize just how large it really was.

The group stood about him silently, almost reverently. Coopersmith knew they were feeling just the way he did.

Without a word, as though speech might somehow break the magic spell of the place, Coopersmith led them down into a reedy meadow, feeling the spongy earth give slightly beneath his boots. Coopersmith studied the odd terrain, feeling twinges of uneasiness, as though the party were violators of some ancient tomb. Mist hung shroudlike over the lagoon. Odd gurgles sounded. Insects thrummed, their buzzings and chirpings cutting through the thick humid air.

They walked upon rusty-colored, weed-choked earth. Bright green vines crept around trees. Small herb-like growths proliferated.

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There was no grass. On both sides of the clearing, all the way down to the marshes, walls of forest stood in green shadow. Palm-like cycads squatted in uncounted numbers, their thick boles and trunks like unstaved barrels, accented with light brown cones. Giant tree ferns exploded with deep green fronds and fresh shoots. An *alien* wood, thought Ian Coopersmith. Never seen before by man. Large, black-limbed conifers grew here, along with sparsely needled evergreens—primitive pines and spruces, tall proto-firs and cedars, thick cypresses which seemed to reach out like tentacled creatures, unbranching hemlocks black and pencil-thin. Presented before them was a skyline of fiercely stark, immobile life. A jungle of steaming shadows so thick, so densely crowded, that it appeared impossible to clear a path through such a natural barrier.

Forever distant, insects hummed constantly. This forest must *teem* with life, Coopersmith thought. Life amidst the broad leafy boughs of the ginkgoes, amongst the soaring redwoods. This was a world never silent, a world fiercely alive.

Something screamed, piercing the stillness of the air. Like the cawing of a crow, the sound came to them, and then was suddenly choked off, swallowed and lost in the forest's depths. The cry broke the thoughts of everyone, pulling them from their private worlds of perception. They once again seemed to be aware of one another. Time had been slipping away from them in this strangely timeless place, Coopersmith realized.

He turned and faced the group. "Somebody sure went to a lot of trouble to do all this."

Nervous smiles. Pohl coughed. Rebecca Thalberg adjusted the straps of her backpack.

"Hard to believe we're really *seeing* it," Thomas Valdone said, dropping down to one knee, cupping a handful of loose soil and plant life in his hand. "That we're really *here!*"

Amos Hagar, the brash exobiologist and world-famous media personality, stepped forward, smiling. "Captain, this is the most important discovery in the history of mankind! Do you realize what this is! What we've found!"

Gazing stoically at the enthusiastic Hagar, Coopersmith said, "I think so," very dead-pan. He'd never liked Doctor Hagar. The man used the media to popularize science, true, but in doing so he watered it down, sugared it to make a palatable drink for the public to swallow. Hagar was known for his gushing enthusiasm and unbounded optimism, his high-flying prophecies about contact with alien life-forms.

Coopersmith noticed that the others were watching Hagar intently, caught up with his burst of childish wonder, awaiting his next pronouncement. Obviously relishing an audience, even here, Hagar stepped away and prepared to address the group, the smile building on his round face. He gestured wildly, like some Victorian actor executing a Shakespearean soliloquy. "Look around you! It's a lost world. . . . *The* Lost World! Look at those trees!" He pointed towards the forest. "Cycads! Ginkgoes! Smell the air! We are standing in the midst of the *Jurassic* age . . . an exact

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duplicate of the environment of Earth as it was 160 million years ago!''

''How can that be?'' asked Rebecca Thalberg, her long dark hair curling beautifully within the edges of her helmet. ''How old is this thing? This . . . ship?''

Hagar spun, almost dancing like a small child in a toyshop. ''Anything which can be conceived can be possible. You can't ask such a question, Doctor Thalberg . . . you must simply accept what undeniably *is!* Look around you!''

Which set off a flurry of comments and questions from the rest of the group. This continued for a few minutes before Coopersmith called them back to order. ''All right. Wait a minute. We don't know any of this for sure. And we aren't going to know until we start conducting ourselves like a scientific team. Huff . . . set up your communications gear right here near the hatch. Everybody keep your helmet-phones *on*. Doctor Pohl, Doctor Thalberg . . . I think you both have some instruments which can get us some hard data. I think it's time we started doing that. . . .''

All of the team resumed their professional attitudes, except for Hagar. He seemed piqued at having lost his audience.

Ignoring the man, Coopersmith continued delegating duties. ''Valdone, you and Hagar will accompany me. Get out the cameras and the recorders. I want everything down on record. And Huff . . . ?''

''Yes sir, Captain.'' Alan Huff's voice came over the helmet phones crisply. Coopersmith liked Huff. Young, very bright, Huff was extremely dedicated. Although he had not known him as long as he'd known Valdone, he trusted the man's sincerity and obligation to duty.

''Patch me in to Copernicus. They must be going crazy, wondering what happened to us.''

Huff made the proper radio links, enabling Coopersmith to detail their incredible discoveries to Kemp and staff. Audio and visual signals from the portable camera gear were telemetered back to lunar base. After a pause no doubt caused by astonishment, Kemp cautioned them to stay close together. Alan Huff was ordered to remain with the homing beacon.

Slowly the group of five advanced across the small clearing toward the marshland and the lagoon beyond it. Coopersmith and Valdone carried their .50-caliber sidearms drawn. The others handled the recording and analytical instruments.

The ground became soft under their feet as they travelled. The insect chirpings paused infrequently, as though the world had suddenly become aware of the presence and was watching them.

Something moved overhead.

Soaring past the glare from the central rod, a dark shape glided easily over them. A smallish, bat-like thing, it headed toward the lagoon, where it skimmed perilously close to the calm surface of the water.

Hagar followed its flight with his camera, trying to keep it in focus. The first sign of advanced animal life: everyone watched it.

''Pterosaur of some sort,'' said Doctor Hagar. ''Looking for its lunch, probably. Funny. Not quite as I had visualized the species.''

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As if on the cue, the first pterosaur's appearence heralded the arrival of more silently gliding creatures. The last in this lazy formation tilted its pointed head and peered blankly at the humans below. Its pointed beak slit slightly, and Coopersmith caught a flash of tiny teeth as it emitted a high-pitched screech. It followed the flight path of the others down to the lagoon.

"Incredible," Valdone whispered. "Just incredible!"

Hagar spoke much louder. "This must have been some kind of . . . of *specimen ship*. An interstellar laboratory. The builders of this ship . . . they must have visited the Earth *so* long ago! A hundred and sixty million years ago. They stopped and picked up samples of Earth's life forms. No wonder—"

"But what happened?" interrupted Rebecca. "It's still *here*."

"*Something* happened," returned Hagar. "I don't know what. An accident? A malfunction? Maybe a disease wiped out the crew, I don't know. But the ship never left our system. It's been here all this time . . . the creatures in it probably developing. Here all this time. *Waiting* for us."

Valdone laughed. "I wouldn't exactly say 'waiting'. Looks like it's been getting along pretty well *without* us."

"What's that?" said Coopersmith. He pointed to the left, past an extension of the forest where it abutted the shallows of the swampland ahead. Indistinct movement beyond the fronds and vegetation . . . something slow, as though travelling with stealth. The shapes beyond the forest peninsula ventured into the clearing. Three large creatures, standing on their hind legs, waddled awkwardly to the water's edge.

Dinosaurs.

"Jesus," said Valdone. "*I don't believe* it."

Coopersmith waved for silence, then spoke in a low voice into his helmet mike. He checked with Copernicus on the quality of the transmission, reporting briefly also on what was taking place. Four other dinosaurs of the same species appeared at the edge of the swamp, all kneeling down on the shorter forelimbs to drink from the placid, reedy surface.

"Iguanodons," Hagar said. "Not exactly like we imagined them but close enough. Evolution *is* taking place amongst these creatures. These are herbivores. Probably harmless as long as one of them doesn't fall on you."

Studying the herd of dinosaurs, Ian Coopersmith remembered their pictures in his books as a child, and shook his head. Iguanodons. They were massive creatures. With dark brown hides, thick, fleshy legs and bellies, they stood on their hind legs and balanced on thick immobile tails. At least four meters tall, they were. Twice a man's height, and probably hundreds of times heavier. Their heads were large, making their small eyes appear even smaller. Their throats hung down from their jaws in loose folds of dewlap. Their movements slow and deliberate, the iguanodons required a long time to properly right themselves on their hind legs after dropping down to drink.

Quietly, Coopersmith and the group closed to within 100 meters of the creatures without disturbing them. Then suddenly one of the taller ones, now

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resting on his back legs and tail, raised his snout upward as if testing the scented air. Instantly, the iguandons' movements quickened. As if acting upon a silent signal, the entire herd began moving away from the swamp, away from the humans and toward the lagoon where a gentle, sloping beach reached down to touch the waters.

"They've smelled us," Hagar said. "Strange scent's driving them off."

No one spoke as they watched the herd attempt to hurry away from the area. It was almost comical to see such massive, ponderous beasts waddling along, their tails and hindquarters wobbling in a swaying, rhythmic motion. The last iguanodon had struggled to its feet, weaving slightly as it regained a delicate balance, and started after the others. It had hardly taken a step when the quiet scene was broken by the furious crackling and rustle of foliage from the forests' edge to the left. A tannish blur of movement broke from the shaded tree-barrier. Something large and quick and almost twice the height of the lumbering iguanodon.

Quickly, the intruding dinosaur lunged for its waddling prey, pouncing upon its back. For an instant the two creatures hung in their bizarre frieze, balanced, not toppling, the dark, muddy brown hide of the prey in sharp contrast to the attacker. It was a large biped with thickly muscled thighs and large splayed hind claws. Its long tail, although thick, whipped back and forth like a cat's as it hunched over the iguanodon, trying to hold its rubbery flesh in tiny foreclaws. The iguanodon fell forward, slapping into the swampy earth with a muffled thud, emitting a weak, bleating cry like a wounded bird. Now the carnivore, a gorgosaurus or something closely akin to that class, went for the kill. In a movement so quick Coopersmith could barely follow, its great jaws opened, flashed a razor set of teeth, and snapped viciously into the iguanodon's flanks. It partially stood, firmly digging its curved talon feet into the bulk of the victim. Then it ripped and jerked its head from side to side. Under the savage attack, the worried flesh of the iguanodon gave way, and a great bloody flap was torn from its side. The gorgosaurus raised its head, holding the cattle-sized piece of meat in its teeth, tossed it slightly and snapped its jaws once more. The entire gobbet of flesh disappeared into its mouth, slipping down slowly, distending the carnivore's throat as it passed down.

"Good Christ," Valdone said.

"Let's get out of here, Captain," Rebecca said. She was backed up by a chorus of similar opinions.

"No, wait!" said Doctor Hagar. "We're safe here . . . he can't see us or hear us. He's busy with his food and he *will* be for quite awhile."

The gorgosaurus jammed his open jaws into the ravaged belly of the iguanodon, tearing out another red section of still-quivering flesh. The iguanodon trembled feebly under the weight of its killer, but to no avail. Its life fluids seeped from the gash in its flank and its small bird-like eyes slid shut. The gorgosaurus ripped and tore, its jaws snapping mechanically. Pieces of hide and red muscle pulled loose from the stilled prey. The feeding was a frenzy that did not stop, as the great lizard head of the killer plunged again and again into the

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warm flesh. Soon its snout was coated with glistening blood, and still it fed.

Rebecca Thalberg cringed away from the scene. Horror and repulsion showed in her expression. Coopersmith read her unspoken plea.

"All right, people, we'd better be getting out of here. We're not—"

"Captain! Captain!" The voice of Alan Huff screamed hysterically in Coopersmith's helmet-phone.

Quickly turning about, the group rushed through the ready terrain of the meadows, swinging back to the right towards the clearing and the rise where Huff had positioned himself. As they approached the entrance hatch area, Coopersmith saw two smallish dinosaurs, no taller than a man, racing towards Alan Huff. Huff knelt on one knee, pistol at arm's length, ready to fire. The dinosaurs were bipedal, long legged, with thin, pointed tails, their bodies tapered up to large-jawed, big-eyed heads. Rows of sharp teeth glinted. Their small forelimbs seemed to dangle helplessly as they ran. Like giant birds, they half-leaped, half-strode across the clearing with the speed of thoroughbreds, filling the air with crow-like caws. Even from the considerable distance, Coopersmith could see the panic in Huff's eyes as he raised the gun and fired off three quick shots into the closest dinosaur.

The volley struck the racing predator in the throat and lower jaw, instantly exploding its flesh in a shower of pink mist. It staggered forward, losing its balance, but tumbling onward as if drunk. Shaking its fearsome head, it spattered blood and small fragments of bone into the air. But still it plunged forward. The second dinosaur, untouched by the explosive bullets, plunged past the first and leaped in the air like a kangaroo, its hindclaws flaring, crushing into Huff's chest.

The communications man managed one last shot, fired wildly into the air, before the beast was upon him. Huff was thrown on his back under the greater weight of his attacker. As Coopersmith's group closed in, they could only watch in horror as the first dinosaur, a compsagnathus, raked its hindclaws across Huff's abdomen, splitting him open like a piece of over-ripe fruit. Instantly, the ripping and tearing began as the snapping jaws pulled Huff apart. The second, wounded predator leaped into the bloody fray, finished the kill.

Hoping he was still in contact with Copernicus, Coopersmith spoke into his helmet mike, barely repressing a yell. "Huff's dead! The place is crawling with dinosaurs. We're getting *out!*"

Valdone fired pistol rounds at the two dinosaurs. Doctor Pohl and Rebecca Thalberg fumbled with their weapons, finally adding to the volley of explosive slugs. The air was filled with gunshot reports and the hideous, keening screams of the dinosaurs, and Coopersmith tried to control his thumping heart and trembling body. Carefully he took aim with his pistol and fired.

New sounds filled the air. Loud bellowing, like that of wounded cattle. Sharp cracking barks . . . as though from the mouths of giant bullfrogs. What had only moments ago been a placid, pastoral meadow abuzz with insects singing was transformed into a slaughterhouse reverberating with death screams. Coopersmith followed the bel-

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lowing sounds and saw a nightmare emerge from the walls of the forest to the right. The others saw it too. For a moment, the sound of gunfire was only an echoing memory.

The sounds of battle had aroused it.

The smell of blood and death had attracted it.

The half-dead, shell-riddled carcasses of the two compsagnathis lay crumpled over the remains of Alan Huff. It was first drawn to this carrion. But as it staggered from the forest, it paused and looked at the five humans, barely fifty meters away.

For a moment they stared at one another, the humans and the allosaurus —eight tons of killing machinery. From head to tail it was more than 12 meters long. Standing on its powerful, pylon-like legs, it towered above them at a height of 8 meters. Its hind legs rippled with muscle-tonnage, sheathed in a yellow-brown leathery hide. Its forelimbs twitched, closing its three-digit claws instinctively at the sight of prey. Its great head, itself weighing perhaps a half-ton, turned slowly, turreting so that it could study the humans with its large saucer-eyes. Its lower jaw hung open, dripping saliva, its throat heaving from the furious beat of its breath. The nightmare head dipped, bobbed and weaved, displaying a row of dagger-teeth, a death's head smile.

Then it raised that head as it passed, nostrils flaring, testing the air, smelling the carrion smells and perhaps the new smells, the new prey. It bellowed once again, and dropped its head, hunkering down, extending its tail almost straight, horizontal with the ground. The great legs moved, and it streaked forward, covering the distance between itself and the humans in two-meter strides. For such a massive creature, it was inconceivable that it could move so quickly, so fast. Yet its motions were smooth and fluid, coordinated beyond belief.

Coopersmith and Valdone stood their ground just long enough to empty the clips of the weapons. The shells ripped through the allosaurus's thick hide with little apparent effect.

It bore down upon them like a steam locomotive.

Rebecca Thalberg ran by Coopersmith's side as the group split up in different directions. Ian and Thalberg to the left, toward the distant forest edge. Valdone, Pohl, and Hagar back toward the marshlands.

This tactic seemed to confuse the giant carnivore. Seeing the prey suddenly divide and separate, it slowed its charge, tilting its ugly head, as if contemplating the movements. Valdone kept running, but Hagar paused for an instant, as if spellbound by the immense creature which closed in on him. The allosaurus had shaken off the distraction and was now continuing on a straight-ahead course. Valdone screamed at Hagar, even turned back to fire two rounds into the thing's head to little effect.

As Hagar shook free of the paralysis that gripped him, the beast was upon him. Dipping its head, with little break in its gigantic stride, it snapped Doctor Amos Hagar, world-famous author, media personality and deliverer of deadly *bon mots,* into its terrible jaws. Hagar did not even have time to scream before the razored edges of teeth closed upon him, slicing him cleanly in half. These were tossed briefly into the air before

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being wolfed greedily into the beast's maw. Swallowing as it lumbered forward, it bore down on Valdone, who was laboring against the moist earth; the spongelike marshland seemed to suck his boots down.

Coopersmith and Thalberg ran mindlessly towards the forest, a glimpse of Hagar's death urging them forward. They ran until Coopersmith's mouth and nostrils felt afire, his legs ached. His mind flooded with thoughtless, boiling chaos. Naked panic. He could feel it in Rebecca as well. The dark green wall of the forest bobbed and jerked before his eyes as they ran.

As they reached the forest, crashing blindly through rough-edged fronds of low-lying ferns, Coopersmith paused, sensing a moment of safety. Reaching out, he grabbed Thalberg's arms, pulling the woman close to him, dropping to his knees. "Wait," he half-cried, gasping for breath. "Wait!"

They turned and looked back towards the marsh where the allosaurus had just overtaken Valdone. Rebecca looked away, but something kept Coopersmith's eyes on the grisly scene. The great beast had actually run over Valdone, stamping him into the soft earth. Now, in a hunting frenzy, the creature savagely clawed at the ground with its hind leg, digging up great clumps of earth, pulling out the mangled remains of Coopersmith's colleague. A bright red mass stuck to the beast's right foot. Slowly, it bent down, examining it for an instant, then snapped it up in two quick bites. A lump formed in its throat, which quickly slid from sight down its gullet. A helpless rage filled Coopersmith.

He felt fear and hate and despair all at one time. "We've got to get back to the hatch," he said finally, shaking Thalberg, making her turn and listen to him.

"We can't make it. Those other things . . . "

Coopersmith looked back towards the hatch. The two cadavers of the compsagnathis had already attracted a crowd. Bird-like carrion eaters had descended upon the bodies and were already feeding. The air above the pile was smeared by a swarming black cloud of tiny insects. The forest noises filled their ears, occasionally pierced by the cries of other predators, now aroused by the scent of the kill, which filled the air.

The allosaurus, having finished with Valdone, stood near the edge of the marshland, pausing to pick its teeth with its forelimb claws. It looked almost dainty as it stood, flicking and pawing at its jaws. Then it held its snout high, trying to pick up the scent of the others. Thus it stood, motionless for a moment. Then it slunk indecisively off towards the other edge of the forest. Coopersmith watched it, wondering where Doctor Pohl had gone.

"It's moving off. Come on . . . we've got our chance right now. Stay close to the trees and we'll work our way closer to the hatch."

"Captain, look!" Rebecca pointed up and across the small meadow to the rise where Huff had been attacked. New shapes had emerged from the forest. Two more bipedal dinosaurs similar to the one they had seen attack the iguanodon. Gorgosaurs, Hagar had called them.

The two new beasts ambled boldly

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onto the scene, instantly scattering the carrion-eating pterosaurs, the insects, and a small crowd of diminutive, pale-skinned dinosaurs that looked like ostriches. The gorgosaurs advanced, their mouths open, jaws drooling, bleating out warning cries which the smaller fellows most certainly would heed. They rushed up to the carcasses and the remains of Alan Huff to begin their ritual of ripping, tearing, and greedy gulping of flesh. There was no way Coopersmith and Thalberg could hope to get past the newcomers.

Nor was this their only problem. The allosaurus was emerging from the edge of the forest, pounding toward the smaller carnivores.

Then Coopersmith saw Pohl, creeping along the outer foliage. Why had the man left the safety of the trees? Gerald Pohl glanced back skittishly as he moved along. Perhaps another meat-eater was converging on the scene, and Pohl was escaping *that* one.

The allosaurus paused, catching some small movement in the corner of its vision, tilting its large head towards the forest edge. Though the great beast was quite stupid, evidently not having evolved much—like the crocodile—in the last 100 million years, its senses were not dull. To be an effective killing machine, to be able to keep such a massive, energy-burning body sated, the allosaurus had to be extremely adept at catching prey. So it possessed keen vision, sensitive smell, acute hearing. It stood now watching the tiny toylike man scamper along the outermost trees.

Plenty of time for the kill.

Doctor Pohl continued to half-run, half-stagger away from the dark forest. He ran with the mindless panic of desperation, which showed in his movement. Deeper in the forest, Coopersmith saw a shadowy form following him.

He was making a desperate dash for the safety of the hatch.

Pohl charged toward the spot where the two gorgosaurs snapped and sidled at one another for the final morsels of the ravaged bodies. The scent of blood and ripped-open bowels was thick in the air. It smelled of feeding time. Coopersmith watched the allosaurus observing Pohl running toward the other beasts, its dim brain no doubt trying to understand what kind of prey would rush into the jaws of its attackers.

The two gorgosaurs paused in their bloody repast, thrusting their snouts upward, catching the human scent. Turning, they seemed to grin. They bellowed with killing-joy. As they began their smooth, loping strides towards the man, Pohl fired three shots at the closest beast, one shell striking the back of its throat. A lucky shot, it exploded the thin layer of bone beneath the creature's brain. Evidently, the shock of impact jellied the nerve center, killing it instantly. The gorgosaur lurched forward, falling on its snout, its hind legs and tiny forelimbs twitching convulsively. Seeing this, its companion, driven by its frenzy of hunger, fell upon its fellow to rip a large piece of warm flesh from its still quivering thigh.

Doctor Pohl pulled up, struggling to slap a new clip into his pistol, trying to think what to do next, when a giant shadow crossed his path. Turning, he saw the steel-muscled bulk of the allosaurus towering above him, gliding quietly and quickly over the soft earth.

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Lowering its head, it opened its jaws. Pohl fired his sidearm wildly before rolling to the left. The light tan hide blurred past him. Scrambling to his feet, running out from between the feeding gorgosaurus and allosaurus, he did not look back.

Ahead of him, angled off to the right, was the entrance hatch. He was not more than 50 meters away. Gerald Pohl staggered forward, leaning, half-falling, to sustain forward motion. Coopersmith held his breath for the man . . . then gasped as the gorgosaurus sprang from its meal and bounded across his path.

"Pohl!" Coopersmith cried. "*Run,* man!"

Pohl did not seem to notice the creature until it was directly above him. He tried to dodge, but to no avail.

Open jaws dropped over his head and shoulders.

Coopersmith averted his gaze as Pohl was decapitated. Never had he imagined such slaughter, such mindless killing and feeding. Rebecca grabbed him and began sobbing and shivering in his arms. She gasped for breath. He wished he could join her in the physical release.

A bellow.

Coopersmith looked up. The allosaurus was advancing upon the gorgosaurus. The two dinosaurs faced each other, barking and hissing as though attempting to scare one another off. Neither apparently wanted to fight as much as they desired to feed. Slowly the smaller gorgosaurus backed away, turning to finally sidestep off toward the forest.

The allosaurus threw back its head, rejoicing in its triumph with a final roar of primordial joy. Then it ambled up to the remains of the dead gorgosaur, and began to rip and tear with reptilian gusto. Coopersmith watched it feed for the better part of an hour. He held Rebecca Thalberg, who was now quietly sobbing. When the allosaurus finished its bloody meal, it slowly settled down, reclining over the skeletal carcass of the victim. Coopersmith knew that it would now fall into a heavy doze—a half-awake torpor, while its great body labored to digest the feast.

Not 40 meters from the hulking beast lay the entrance hatch and safety. After seeing the quickness of the predators of this world, the unmerciful death they held in their claws and jaws, Coopersmith knew that he would not risk trying for the hatch as long as the allosaurus remained close at hand. He felt defenseless against the hostile world they had found. It was an arena of twisted nightmare, full of God knew what else beside the dreadful things they'd already seen devour their companions.

"C'mon. We've gotta move a little further back into the foliage."

Rebecca wordlessly obeyed.

They slid past the brushing vegetation, crawled over fallen trees for some minutes.

Something rustled in the forest behind them. Ian tensed.

"What is it?" Rebecca asked.

"I don't know. The smell of blood keeps drawing more to the area. Not safe back there now. That's why we're moving on just a bit."

"What about the hatch?"

"No way. The big fellow's out there sleeping it off. I don't want to wake him up." Ian patted her protectively on the shoulder. For a moment, she relaxed. Then she gazed upwards.

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"Ian. Look . . . Look at the light. It's getting dark! Oh my god, no . . . It's getting *dark!*"

Coopersmith studied the junglescape and noticed that the colors seemed a bit more saturated, that the shadows were deeper, darker than they had previously been. Flipping down his goggles, he stared up at what he could see of the light rod in the faraway center of the cylinder.

It *did* seem dimmer. More solidly defined.

He held Rebecca for a moment after flipping up the goggles. "You're right. The light source must be timed, automatically, so that it produces a natural cycle of night and day."

Rebecca shivered. "Ian, I don't think I can stand it here in the darkness. . . ."

"Let's get away from the clearing. The safest place would be up in some high branches. Can you climb a tree?"

"*Sure* I can," she said, almost indignantly. She was recovering her spunk. Good, thought Coopersmith. She'd need it.

They stood and walked cautiously further into the cooling shadows of the forest as darkness descended. The world was again lulled into false serenity by insects.

A cry of hunger pierced the growing darkness.

END OF PART ONE

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Ruth B. Kaplan

Weather modification has come a long way—but still has a long way to go.

What Have They Done to the Rain?

In the 1980s we commonly assume we are masters of the planet—that we can control our environment at least theoretically, if not in practice. But this is not true. Despite spectacular scientific advances during the last two decades, it is still unreasonable to expect miracles from scientists. A case in point is weather modification—the modern-day rain-making business.

Weather should be simple. It is ruled by mechanical and thermodynamic principles which have been known for over a century. So all we need do is nudge a hurricane here, stimulate some rain there, and we get a weather utopia, right? What, you say we still don't have all the methods down pat? A small grant from the government should be sufficient to work out the kinks, right?

Wrong.

First of all, do we even know what it is that we are proposing to do? Weather modification has been defined as "any activity performed with the intention of producing artificial changes in the composition, behavior, or dynamics of the atmosphere." This covers everything from rain dances and prayer to lightning rods and trees planted as windbreaks. Everyone talks about modifying the weather, but nobody seems to agree on how to do it.

Part of the problem is that weather prediction is still more art than science. Despite worldwide radar systems and growing data banks of past weather statistics, there are still too many variables interacting in too many complex ways to do more than make a statistically based prediction. "There will be a 50 percent chance of rain tomorrow," you hear on the evening news. You have visions of the weathermen playing poker with rain and thermometers rather than chips. Yet what this really means is that, in previous similar arrangements of clouds and weather systems, it rained in half of the recorded instances.

Statistical forecasts are usually either useless (50 percent chance of rain) or self-evident (90 percent chance and it *is* raining). These predictions are somewhat useful for picnics and ski trips, but when the meteorologists sit down to try to change the weather, they need much more detailed, cloud-by-cloud information. Since usually they only get to

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work with one or two clouds in an entire weather system, they have to be able to tell if they really changed what would have happened. This requires a careful comparison between their experimental results and their observations of how the weather normally behaves.

Like the weather forecasters, experimenters use statistics to determine if they have been successful in modifying cloud behavior. Records kept by meteorologists around the world over the past century help to give a picture of the average or "normal" weather for an area. Insurance records provide indicators of the severity of floods, hailstorms, hurricanes, and fires caused by lightning.

It would seem that an experiment would be relatively simple: a method, such as cloud seeding, is applied, and the resulting weather is compared to that normal for the area. But the statistical nature of weather knowledge makes it necessary to repeat experiments a number of times over a long period. Often a secondary variable is used as an indicator of the actual physical phenom-

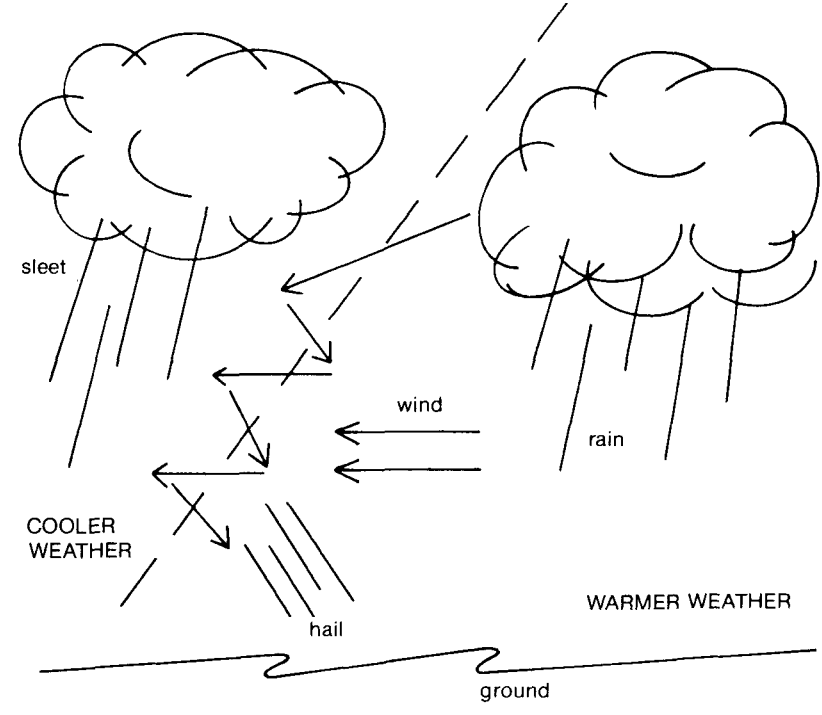

Figure 1. Precipitation. Sleet is formed when rain freezes in colder air. Rain falls when the air is warmer. Hail can fall in warmer air, since it is formed by being tossed between the cooler and warmer regions.

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enon being modified. The severity of a hailstorm, for example, is often measured from crop yield statistics. However, many factors affect crop yield: rainfall, mean temperature, and insects. Additionally, a particular crop, such as tea, may be particularly sensitive to hail damage. Thus the relationship between changes in crop yield and the implied hail severity often becomes disputed and unclear. Also, the choice of the period to be used for comparison with "normal" events can affect the interpretation of the experimental results. Subtle trends in weather may go unnoticed if only limited data are available, allowing use of atypical statistics for a "normal" base line.

How Does the Weather Work?

As if the meteorologists did not have enough problems, their models of weather behavior are not too reliable. Rain, snow, sleet, and hail are grouped together as "precipitation." Which one occurs depends upon the temperature and saturation of a cloud with water droplets. When the temperature and humidity coincide at the proper levels with the existence of salt crystals, cloud water droplets condense around the crystals. Rain forms when the temperature is above freezing. In order for the droplets to freeze, they must be chilled to $-40°C$, rather than the usual $0°C$ freezing point for water. No one knows why this is so. The result is that a cloud often is a mixture of snow and rain; the snow crystals coated with a layer of water, sticking them together into larger flakes. This is a highly simplified model of the actual process that occurs in clouds all the time.

Hail forms when rain falls through a cold layer of air, and the drops freeze into pellets of ice. (*See Figure 1.*) Hailstones develop when these ice pellets repeatedly blow through warmer and colder air layers, building up multiple layers of ice into larger pebbles. Thus, hail can fall in relatively warm weather, if there is a colder air layer higher in the atmosphere.

Fogs make rain and hail seem simple phenomena by comparison. There are three primary kinds of fog: radiation, advection, and evaporation. (*See Figure 2.*) Radiation fogs usually involve a lower, cooler layer of air overlaid with a warmer, drier layer. They often form during the winter months when the air layer near the ground is kept cold by it and is overlaid with a warmer air mass moving in from somewhere else. Advection fogs and evaporation fogs are opposites: when a warm, moist air mass moves over a cold surface, such as snow or a cold lake, an advection fog results. Evaporation fogs form when cold air moves over a warmer water body. In all cases, the key factor is the intersection of warm, moist air with a cooler temperature that condenses the water into droplets. The smaller the droplets, the lower the visibility distance. This explains why you can see farther in rain than you can in fog. Radiation and advection fogs are termed cold fogs, since the temperatures of their water droplets can fall below freezing, while evaporation fogs are warm fogs. These characteristics are important when attempts are made to disperse the fog.

Hurricanes are severe tropical storm

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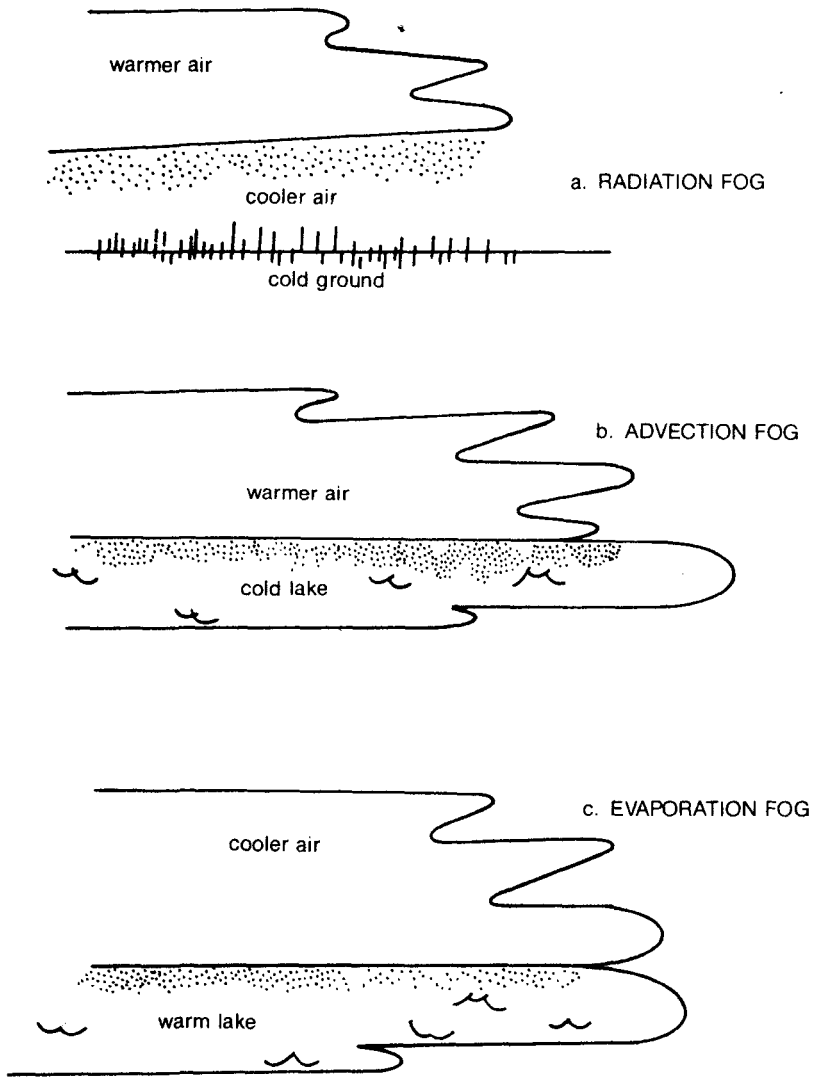

Figure 2. Types of fog: (a) and (b) are cold fogs; (c) is a warm fog.

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systems that originate near the equator as tropical depressions: areas of low atmospheric pressure. Why some tropical depressions grow and organize into the spiral hurricane pattern and others do not still mystifies meteorologists. Likewise, we still cannot predict how fast and in what direction these storms will develop and travel. The storm usually forms around a small circular eye in the center where the air is clear and still, with spiral arms of clouds and winds coiling out from the eye. The tighter and smaller the storm, the fiercer the winds at the outer limbs. Many of the problems with dispersing hurricanes are due to a lack of working models to explain their formation and behavior.

Even more mysterious than hurricanes is lightning. Everyone agrees that lightning consists of a flash of light caused by a discharge of atmospheric static electricity. But, believe it or not, we have traveled to the moon and back without being able to explain what sets off the electrical discharge or exactly how lightning occurs. One theory has it that strong static electrical fields form on the water droplets within a thundercloud. Another theory is that the fields concentrate at the tips of ice crystals in the cloud. A recent speculation is that cosmic rays produce ionized electrons along the lightning bolt's path to Earth, so that a current line is set up. Modification of lightning is hindered significantly by our inability to explain a mechanism for its formation and behavior.

What Makes A Good Experiment?

In the absence of working models for the mechanisms behind weather phenomena, experimental method becomes the chief issue in evaluating the resulting data. Due to the funding problems experienced by researchers, often the data collected either lacks proper experimental design or is incomplete for a fair comparison of the results with base line—"normal"—weather conditions. Academics who rigorously design efforts to preclude experimental bias often lack financial backing for long-term data collection. Commercial cloud-seeding companies who have been conducting operations for years have little motivation to design their procedures rigorously. In fact, if anything, they want to convince their potential customers of the effectiveness of their methods by applying them as much as possible. Thus, not only do they employ saturation treatments, they also have a tendency to publicize only favorable data. The problem is compounded by commercial companies which publish their results alongside those of the academic researchers in the meteorology journals. This produces an uneven patchwork of reports, each with its own shortcomings.

Conclusions reached in a particular project are not generalizable to others, since weather patterns vary geographically. Thus, experiments performed in Jordan or South Africa do not apply to weather in the Great Plains. Additionally, experiments often cover only a very small portion of the area that would be necessary for full-scale weather modification operations. Extrapolation from small areas to large regions is still an undependable method of interpreting

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data.

Beyond the limitations of meteorological models and experimental design, statistical procedures for data interpretation are often disputed. As a relatively young science, weather modification must depend heavily on the statistical interpretation of empirical data. However, these interpretations are highly unreliable in comparison to the results of sciences such as physics and biology, which have been studied quantitatively for centuries. Meteorology itself is still an empirical science, and weather modification extrapolates on the conclusions of meteorology. Only when we can reliably predict the weather can we systematically start controlling it.

The key to any meteorological experiment is the choice of a representative variable that will accurately indicate changes in the weather being studied. We can simply measure the amount of rain that falls at various points on the ground. Hail is a different matter. Are we interested in hailstone size, rate of fall, or damage to crops in dollars? Once a variable is chosen, the mode of measurement can cause still further problems. A rain gauge seems rather straightforward. Yet recent experiments show that the total rain output of a cloud system is dependent on the total area and rate of rainfall, as well as the volume at a given point. Similarly, if we choose to use property loss figures as the indicator of forest fires caused by lightning, we must account for fires started by other sources, such as campfires and arson.

In the September 1979 issue of *Analog*, a story appeared that depicted a weather modification war between the U.S. and the Soviet Union.* Stories such as this one raise the question of the military applications of weather modification techniques. There is little doubt that, once the methods become dependable, tested strategies, they could serve as an extremely powerful and subtle weapons system, as depicted in the story. However, to be effective, the methods will have to be highly reliable—not a characteristic of current weather modification efforts. In fact, much of current military interest in weather modification research is in the peaceful area of fog dispersal, since fog is a major problem in military aviation in some areas of the world.

Can We Make It Rain?

The oldest form of weather modification (save prayer) is rain-making, or precipitation enhancement, as the meteorologists prefer to call it. The origins of this method are shrouded in the obscurity of the birth of agriculture. As long as there have been farmers, there have been droughts—and men willing to try to bring rain from the intransigent skies.

Modern techniques are based upon current theories of rain formation in clouds. Rain cloud formation is largely determined by water saturation, the amount of water suspended in the cloud. Clouds grow by combining with other clouds and becoming more saturated with water. Modern-day rain-makers try to stimulate rudimentary rain clouds into combining with other clouds to form active rain cells. The clouds are seeded

*"Sturmkrieg," by Ronald R. Lambert.

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with a material that provides nucleation centers for the freezing of the supercooled water in the cloud. Contrary to many popular accounts, the raindrops do not form around the nucleation centers and then fall. When the droplets freeze around the nucleation centers, heat energy is liberated into the cloud by the formation of ice crystals. (Water at 0°C contains more energy in molecular motion than do ice crystals at the same temperature.) The additional heat in the cloud makes it rise and merge with other clouds in the rain cell. The cloud becomes an active rain cloud when it reaches sufficient saturation for the water to precipitate.

Clouds can be seeded from above by aircraft, or from the ground via updrafts that carry the seeding material into the growing cloud. Dry ice was originally used in the "on top" method, but storage problems, processing difficulties, and the requirement for relatively large amounts soon led to its abandonment in favor of silver iodide. Silver iodide crystals have the advantage of being useable for ground-based seeding, dispersed by acetone burners. In the early days the search for an efficient vehicle to burn the silver iodide-acetone mixture led meteorologists to try everything from string to corncobs. By the mid-fifties, though, they were back in the air, spreading silver iodide crystals with pyrotechnic flares dropped into the tops of the clouds.

Ironically, operators turned back to dry ice in the sixties, as they had discovered several advantages to it over silver iodide. The silver iodide method depended upon cloud temperatures to freeze the water droplets, whereas dry ice creates instant results, freezing the water upon contact with the crystals. Dry ice also has the advantage of being dispersed continuously in pellets, providing more uniform distribution and better results than the flares. Finally, the rising cost of the silver in the silver iodide combined with concerns about the environmental impact of indiscriminately dumping tons of silver into the atmosphere each year to make carbon dioxide pellets the optimal seeding method.

One of the ongoing projects to study the effects of cloud seeding upon rainfall is the Florida Area Cumulus Experiment (FACE), being conducted by the National Oceanographic and Atmospheric Administration (NOAA) in a 5,000-square-mile area south of Lake Okeechobee. Operations use a double-blind experimental scheme in which the scientists who choose the clouds to be seeded, drop the silver iodide, and interpret the daily data do not know whether the cloud was truly seeded or if dummy flares containing sand were dropped. Scrupulous care is taken to avoid any subliminal biasing of the data by correlating the rainfall data with the seeding days only every three years.

Rainfall is measured by rain gauges scattered throughout the area which record both amount and time of rainfall. Two radars track the rain through the test area and assist in estimating rainfall. Operations are conducted in the summer months, using up to two pounds of silver iodide per cloud. Experimentation days are chosen using a suitability criterion that biases against rainy days since, after all, seeding clouds that would rain any-

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way would demonstrate little.

Statistics collected between 1968 and 1970 indicate that the effect of seeding upon rainfall is "large, positive, and significant." In other words, seeding produces significantly more rain than would have fallen naturally. Cloud systems formed by the merging of several individual seeded clouds were shown to produce more than ten times more rain than isolated seeded clouds on the same day.

The second phase of FACE, conducted from 1970 to 1975, categorized rain clouds as moving or stationary, according to the behavior of the radar echoes produced. This radar echo motion is complexly related to the average wind speed and direction in the atmospheric layer containing the rain cloud. The major conclusion was that these echo motion categories could be used as a predominant variable in accounting for rainfall variations. FACE meteorologists more tentatively concluded that seeding moving radar echo clouds significantly increased the total variance in rainfall, preventing rain as often as stimulating it. Results from stationary echo clouds were even more dubious. While these conclusions may seem obscurely technical, they do actually reflect progress in the research: seeding certain types of clouds can significantly increase rainfall. The FACE study assisted, although in a limited way, in defining which types of clouds will respond to seeding.

The validity of using rain gauges arranged in a square grid pattern on the ground to measure rainfall has been questioned as a result of a cloud-seeding program conducted in Israel and Jordan. In this case the seeding operation not only produced more rain; it also expanded the total area of the rainfall. Data indicated that the total rainfall measured by a rain gauge is a function of both increasing intensity of rainfall and prolonged exposure to rainfall as the larger rain pattern passes over the gauge. A more accurate picture of the storm's rainfall might be given by recording rainfall rate in centimeters per minute, or else by totaling the water yield of the entire storm from all the rain gauges in the area receiving rain.

As the possibility of rain-to-order becomes more real, we must begin to examine whether more rain is always beneficial. Too much rain can cause flooding, and rain at the wrong time in the growing cycle can ruin rather than aid crops. Farmers often grow crops with different rainfall requirements side by side in adjacent fields. Other industries do not benefit at all from increased rain. Construction companies must halt work and dry out, for example, and there are more automobile accidents during periods of increased rain. These detrimental effects must be weighed against the substantial economic benefits to be gained, such as converting arid rangeland to lush pastures. Precipitation enhancement cannot eliminate droughts completely, but even small increases in rainfall during dry spells can make significant differences in agricultural production.

Another concern among farmers is that one area will "steal" rain from another by "catching" the clouds and seeding them. When precipitation en-

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hancement becomes a reliable, commonplace technique, guidelines will have to be devised to ensure fair distribution of resources. In actuality, diverting rain would not be feasible for an individual farmer or even a town. It would take a massive seeding program over an area the size of a state before "skyjacking" rain became possible.

A final consideration when evaluating the effectiveness of precipitation enhancement is the trade-off between its costs and those of other methods of increasing crop production, such as new seed hybrids and chemical fertilizers. As long as rain-making remains a relatively risky endeavor, farmers will prefer the more reliable alternatives they have used in the past.

Since the meteorologists use the term "precipitation enhancement," it may seem strange that we have discussed only rain. The reason for this is that the formation mechanisms are thought to be similar; thus cloud seeding can be used to stimulate rain or snow, depending upon the temperature of the air layers between the cloud system and the ground. The key steps are the cooling of the cloud, saturation of the air with water droplets, and the formation of drops large enough to fall to the ground. Cloud seeding can be used to stimulate these processes independent of air temperature below the cloud.

Clearing Fog

Suppression of cold fogs is one of the few undeniable successes in weather modification. Land, sea, and air traffic are all extensively disrupted by the chronic, dense fogs common to many areas of the world. Airports in the Pacific Northwest are particularly subject to being "socked in" by super-cooled fogs that reduce visibility below safe flying limits. Since cold fogs resemble clouds on the ground, the fog is seeded to freeze the supercooled water droplets. The liberated heat from the freezing water raises the temperature of the fog to the point where the droplets revaporize.

Unfortunately, warm fogs require other techniques. Warm fogs are a problem because the droplets are too warm to freeze and so must be dispersed in other ways. In hygroscopic seeding the fog is sprayed with large amounts of a solution designed to absorb the fog droplets. Some of the larger droplets precipitate, "clearing the air" in a literal sense. The remaining water droplets are larger than the original fog particles, and visibility is improved since it increases with the size of the water droplets. Burners are used on runways to lift a warm fog by means of a warmer mass of air. Some researchers have suggested using a high-energy laser to burn a hole through the fog, allowing airplanes to land and take off. Of these methods, only seeding actually has been tested, and none can be viewed as proven techniques.

Is Hail Controllable?

While fog dispersion techniques are widely agreed upon, hail suppression methods are a source of almost universal discord. The need for hail suppression is undisputed. Property and crop damage is a significant factor in the local economies of hail-prone regions the

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world over. However, evidence indicates that hail suppression requires large-scale operations, covering more area than only two or three counties. In addition, the actual economic benefits to farmers are often offset by insurance and reduced food prices resulting from larger crops. Nevertheless, because farmers would rather bring in a larger crop than a smaller, damaged one, interest in hail suppression remains sizable in high-damage areas.

Part of the controversy surrounding hail suppression centers on the exact mechanism of hail formation. The commonly accepted theory is that hailstones freeze around particle nuclei such as dust or salt crystals in the cloud. The more particles, the smaller the hailstones, since presumably the same amount of water is distributed among a larger number of hailstones. Since most of the damage done by hail is related to hailstone size, this becomes an important variable in hail suppression. Relating damage estimates to hailstone size for comparison with experimental data becomes yet another area for disagreement between researchers, who prefer disparate methods.

Because hail is such a variable phenomenon—under similar sets of conditions it may fall heavily one day, while the next time not at all—the results of attempts at hail suppression depend heavily on proper experimental design. Daily operations criteria are designed to eliminate bias from the process of deciding on which days to conduct the experiment. If weather conditions pass the operations criteria, a random factor is used to determine which days the clouds are seeded and which are to be the control days for comparison. On control days the clouds are seeded with sand flares, to ensure that the plane flying through the cloud does not affect the results. However, different interpretations of the operations criteria by different researchers during an experiment can effectively vary the actual operations criteria in subtle ways. Also, limitations of the experimental operation may bias results. If the plane cannot climb quickly enough to seed rapidly building hail clouds, or has other inherent performance characteristics that affect which clouds get seeded, significant but almost undetectable effects on the data may result.

The choice of control data used for comparison may also bias results. The Nelspruit Hail Suppression Project in South Africa used historical records for comparison, since it was a commercial operation and seeding days were not randomly alternated with non-seeding control days. Preliminary analysis indicated that the program had succeeded in reducing crop loss by more than 50 percent. However, closer examination of historical data revealed that the control period was too short: there had been a recent trend of increasing crop loss due to hail damage which distorted the control data, since it did not reflect "normal" hailfall for the area. Using an extended baseline set of control data, the experimental results were not as spectacular (though still significant), since the reduction in percentage crop loss was not as great as previously believed.

Sometimes a successful technique

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will have side effects that may cancel its benefits. Additional examination of the experimental data in the Nelspruit Project showed that reductions in crop loss were achieved at the expense of a proportionate increase in the total area of hail incidence. Analysis showed that the farmer would come out ahead simply by insuring against hail damage, then taking the insurance money, rather than investing in hail suppression.

One positive conclusion of the Nelspruit Project was that, while the area of hailfall was increased, the decreased severity of the hail also would benefit crops such as corn, having higher damage thresholds than the experimental crop, tobacco, which is extremely vulnerable to hail damage.

Another commercial program, conducted in the Panhandle region of northern Texas, also compared experimental data with historical records, but used additional data from surrounding counties for the same time period as the hail suppression program. Losses in the two test counties were not only below historical levels, they were also lower than those of the surrounding counties. These results constituted a significant decrease beyond that of a recent trend of lower crop damage level in the area. This hail suppression program is one that can be considered a success.

A Kenyan hail suppression program attempted to compare the relative effectiveness of silver iodide in sodium (NaI-2AgI) and ammonium (NH_4I-AgI) solutions. This six-month project strongly suggested that the incidence of hail and amount of crop damage was significantly lower for the ammonium complex than for the sodium. The researchers concluded that ammonium iodide was 75 percent more effective than sodium iodide. The sodium complex is hygroscopic (think of how quickly salt absorbs water on a humid day) and quickly attracts water molecules. The ammonium complex, on the other hand, tends to break down into its ionic constituents—nitrogen, iodine, and so on—leaving a relatively pure silver iodide "molecule" which acts as a much more effective crystallization nucleus than the sodium silver iodide complex with water. These results show that much work remains in the area of seeding materials, as well as technique.

Handling Hurricanes

The most massively destructive weather phenomenon is the hurricane. Hundreds of millions of dollars' damage and hundreds of lives are lost every time these powerful storms move inland over populated areas. Presently, the only defenses are avoidance and forewarning: meteorologists follow tropical depressions and, if they develop into major storms, warn the cities in their paths. Any progress towards control or dispersal of such storms would be a major improvement over current methods. Therefore meteorologists are prompted to try, as chancy as the attempt may be.

The Stormfury Hypothesis calls for heavy seeding around the storm's eye. The clouds are thusly heated and should rise, breaking down the tightly organized structure of the eye and slowing down the storm's rotation. The effect is cumulative since, as the storm broadens, its outer edges must slow down due

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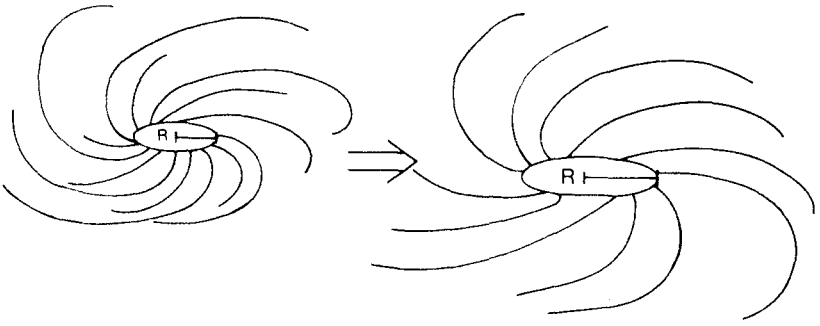

Figure 3. The Stormfury Hypothesis: Since the angular momentum of the storm is a function of the radius of the eye and the wind velocity at the edge, the wind velocity decreases as the radius increases. The eyewall is seeded to dissipate the center of the storm, resulting in lower wind speeds in the limbs.

to conservation of the total angular momentum of the storm and increased edge area exposed to drag from the surrounding air masses. (*See Figure 3.*) While the Stormfury method would not reduce the rainfall delivered by the storm, it is designed to reduce the destructive power of the high winds at the hurricane's outer edges.

Another theory counters the Stormfury Hypothesis with the criticism that it is a technique dependent on using enormous quantities of seeding material, whose effects last only about thirty minutes. The alternative is to seed the eyewall, the vertical clouds at the edge of the eye, to cool the convection clouds around the eye. By reducing the buoyancy of the air in the eye, a new equilibrium would be forced on the storm, reducing the wind velocity on a more permanent basis.

Unfortunately, only four hurricanes have been seeded, all with inconclusive results. These methods will remain theoretical until a significantly larger number of hurricanes have been seeded. The required data base for statistical analysis of hurricane behavior is larger than for other, less violent, and variable weather phenomena, making it difficult to foresee conclusive success with any method in the near future.

Some serious questions have been raised concerning the economic advantages of hurricane suppression activities. Even a highly successful systematic program will not be able to suppress every storm, every year. The public could become complacently accustomed to effective storm suppression and might not prepare for the onslaught of a major hurricane. The damage wrought in just one unanticipated storm could outweigh all the savings from the previous years of successfully suppressed storms. Even when the science of weather modification becomes more exact, the human reaction to its effects will have to be evaluated and recognized.

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Can We Tame Lightning?

One last area of concern in weather modification is lightning suppression. As with other phenomena, one of the chief problems is the lack of agreement on the physical mechanism that creates flashes of lightning. Despite the lack of a working model, property and forest damage from fires caused by lightning have motivated some attempts to experimentally control it. Most of the research is based on the theory that the lightning stroke is initiated by an electrical field that exceeds the threshold for corona streamer propagation and intensification. Corona streamers are the minute discharges that precede a lightning stroke. They originate from charged droplets with corona fields exceeding the threshold, which depends upon atmospheric conditions.

Efforts to suppress lightning have centered on decreasing the corona fields on each droplet of water in the cloud by increasing either the number of highly conducting particles or the number of very poorly conducting ones. The highly conducting bodies, such as metallic slivers, spread out the electric field among more particles, so that no individual droplet or sliver has sufficient charge to initiate streamers. Very low conducting materials such as ice needles are also used to try to control the corona fields. Poorly conducting materials can build up large charges before they will discharge. If both types of material are used for seeding thunderclouds, this theory presents the possibility of controlling lightning discharges.

A more recent theory of lightning suppression was brought about by the lightning strike during the launch of Apollo 12, when the launch vehicle was struck by lightning during liftoff. What surprised scientists who studied films of the incident was that the rocket evidently stimulated the lightning. This observation originated the concept of controlled lightning discharge, as opposed to actual suppression. The new theory has applications far outside the realm of protecting the delicate electronic systems onboard a space launch vehicle; it could be used in reducing forest fires, for example.

The technique of controlled lightning discharge involves launching small rockets into thunderstorm clouds to attract the discharges which might otherwise develop into larger lightning bolts. This method has been qualitatively tested, and it has been concluded that small rockets do increase and modify lightning activity in thunderstorms. Although further testing will be needed for a quantitative evaluation of this theory, it is clearly a potential new concept in lightning suppression and control.

What Do We Need For The Future?

As we have seen, weather modification has a long way to go before it can be considered an exact science. It also must overcome the poor public image that it gained in early years due to unfulfilled claims made by unscrupulous commercial operators. If nothing else, a concerted effort should be made to produce more credible research with results that are not wishful thinking or empty, sweeping success claims, but realistic assessments of our capabilities to cope with atmospheric vagaries. In addition, a comprehensive and careful

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assessment should be made of the full economic impact of any large-scale program on all aspects of society. Much of the public suspicion and distrust of weather modification technology stems from unreasonable expectations based on unsubstantiated claims and from a basic fear of losing control of resources basic to their livelihoods.

Current research efforts in weather modification are fragmentary and uncoordinated, and will require several decades to produce sufficient data to enable scientists to develop working models. National priority for weather modification research and development is low, thus so is funding. Meteorologists are caught between having to obtain their money from the federal government and being accused of developing weather modification as a military weapons system. Despite the obvious unreliability of current techniques, the charge of weapons development habitually seems to creep into discussions of the national interest in weather modification. It seems futile to argue that the current methods are simply too unreliable for use as a weapon, since some people prefer to assume that research will lead to dependable methods which will then be used by the military. One might just as well argue against computer research on the grounds that computers are used to control military weapons systems.

Several scientists have expressed the opinion that the best long-range solution to coordinating weather modification research is for academic and commercial researchers to combine forces and finances. Such a union would benefit commercial operators by improving and proving techniques, and would assist academic researchers by providing useable data from all operations funded by farmers. This cooperative effort has the added advantage of self-management without resort to federal regulation or control. Past experience has shown that avoiding federal oversight of research efforts can only benefit, since federal involvement invariably seems to expand the bureaucratic concerns of a program while neglecting the actual research. Scientists and businessmen can and should manage their own research programs.

The future of weather modification is hopeful—there is considerable evidence that reliable methods can be developed to control the vagaries of weather. The question is: How long before meteorologists pass from the image of the nineteenth-century rain-maker into the image of the twenty-first-century weather engineer? ■

FURTHER READING

The results of the FACE study were reported in *Science* (April 9, 1971, and February 26, 1977, issues). An example of alarmism at possible military applications appeared in the *Saturday Review* of February 5, 1977. If you can find them, reprints of the periodic conferences on weather modification are instructive. For the intrepid reader who can read either around or through statistical mathematics, the *Journal of Applied Meteorology* is the primary source of reports on the current research. *JAM* also has interesting articles on the eco-

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nomic and social aspects of weather modification.

ABOUT THE AUTHOR

Ruth B. Kaplan works for the Air Force as an engineer, and has been involved with meteorological problems in microwave communications systems. She lives in Boston, has been writing science fiction and popular science articles for two years, and hopes to write full time when she leaves the Air Force next year.

The information and opinions contained in this article are solely those of the author and should not be interpreted to necessarily represent the official policies of the U.S. government.

● The key to longevity is creativity; the notion of degeneration of brain cells beyond a certain age is true only in the absence of creativity. It seems to me that there is a direct connection between creative thought and involvement in life and the production of epinephrine by the adrenal gland. When the challenge stops, the supply is turned off, the will to live stops, and the body chemistry no longer functions.

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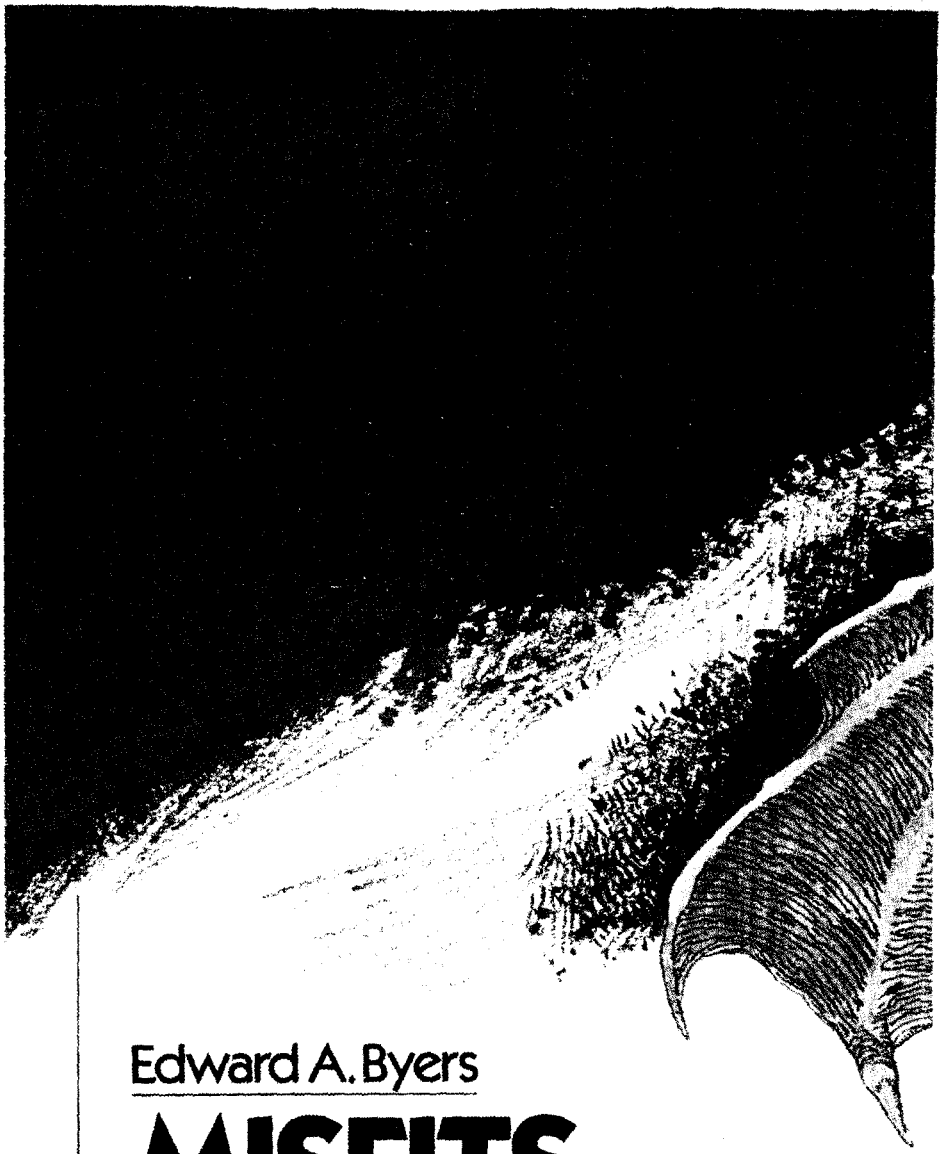

Edward A. Byers

MISFITS

Tastes differ—not only
from person to person,
but from time to time,
in response to experience.

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Ephram Nicholson glanced out of my office window, raised ancient eyebrows.

He said, "Take a look, Maggie. They're coming in already. Two whole days before shuttle-fall."

I put down the tract I'd been reading—*Control of Bovine Parasites*—and stood so that I could peer over his shoulder. An air-sled was approaching. It crested a ridge two klicks away, a dust plume feathering up behind it.

"Can't make out who it is," Ephram said, "but he's coming from the south. Who lives out that way—Mike Arlen? Sam Lomberg?"

"Among others," I said. I gave a resigned sigh for the predictability of mankind-male. There would be more air-sleds soon, and by shuttle-fall the town would be overflowing. That would be a busy time for me, with all the patching up I'd have to do. It was inevitable, of course. When bushlanders got together they invariably drank. And when bushlanders drank, they just as invariably fought.

It was always that way when the shuttle was due to land. Oh, sure, the shuttle brought trade goods and mail from Earth, but that wasn't why Nolava filled up with farmers wearing the best clothes they had, clean shaven for the first time in months.

There was really only one reason.

Women—brides for the men of Palmstar.

The settlement was new; most bushlanders could count their homestead time on the fingers of one hand. Others of us had been there a decade or longer, and one of us (Ephram Nicholson) could remember first planet-fall.

Opening new planets is hard, and the men who came to tame Palmstar *were* hard. Either they broke the planet, or the planet broke them. No middle ground.

They were lonely men, too. And, as if addressing that need, every eight months a starship made a layover, shuttling down mail and staples, bringing news of the universe outside. Bringing women, too, a trickle of fresh female faces that whetted the appetite but did not slake the thirst of the six-hundred-odd bachelors on Palmstar.

Outside my office came a whiffling growl that signaled the approach of the air-sled. Through my window I made out another plume of dust in the far distance. Time to get ready. I checked my medical bag to make sure there were sufficient bandages and enough antibiotics and followed Ephram outside.

"Morning, Eph. Morning, Magpie." Sam Lomberg eased his six-foot frame out of the air-sled and gave us both a grin.

"Morning, Sam," Ephram said.

"Don't call me Magpie," I said, and glared. Sam had made planet-fall the same year I had. He had been married once, to a shuttle-bride, but she died in an avalanche. Since then, he'd made each shuttle-fall, looking for a new wife. It was a sign of his desperation that he'd once considered me a replacement.

Sam continued to grin. He opened his mouth to retort, and then shut it. The second air-sled was approaching, its motors grinding down to a low roar.

"Be damned," Ephram said softly. "Dalvar Sweete's come for shuttle-fall."

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The creature that got out of the second air-sled was just that—a creature, a nightmare that walked like a man. His body, human enough once, had been altered to function in the super-hot atmosphere of Lythe, a planet in a blue star system.

The lower part of his small body was thin, tough, carapaced, and from his shoulders rose high non-functional wings. On Lythe they were used as parasols, shielding against the hot star's rays.

But it was his face that inspired terror. It resembled most one of the gargoyles that grace medieval towers, one of the guides on the way to Hell. He had settled on Palmstar because Lythe's blue sun was heating up, making Lythe uninhabitable even for such as he. It was unfortunate that the alteration procedure was not reversible.

"Hello," he said, croaking. His eyes burned charcoal-dark behind their actinic lenses.

"Hello," Ephram said equably. "You come for shuttle-fall?"

"That's right." Dalvar Sweete's mouth split into a grin. I hoped he wouldn't do it often. If he looked into a mirror he would scare himself to death.

Then it hit me. He had come for shuttle-fall—*he was looking for a wife!*

The shuttle landed two days later. It fell at first, like a bright silver spear. Then it braked, the sound a deep *halloowing* bone-level throb. *Greetings, dirt-grinders.*

But the captain was friendly enough. Pelosi—an old acquaintance. He nodded briskly, then cast an ironic glance at the throng of bushers lining the blast-fence.

"Your zoo is growing, Maggie. How the hell do you keep them in line?"

"Animal tranquilizers," I murmured, and under Pelosi's stare, added brusquely, "don't forget—I'm part of the zoo."

"Never." He gave me a smile, and it was plain his regard for me was genuine. "There's a berth aboard the *Crispin* anytime you say."

For a moment I didn't feel dumpy and middle-aged and homely; I was in his aura. Then I looked beyond him and saw the first of the women emerge from the hatch. Reality came back with an unrelenting lurch.

There were six of them, and not all were beauties. But they had youth, and freckles, and eyes all full of wonder. And breasts that swelled the tops of their dresses, and hair that shone in the light of Palmstar's sun.

Greetings, indeed, dirt-grinders.

"I'm Maggie," I said, and held out my arms. "Welcome to Palmstar."

Sometimes when the day's work was done Ephram and I liked to walk. It had to be after the sun was down, but before the full encroachment of night. Wait too long and there was a distinctly unpleasant bite to the air. That evening Ephram took note of my mood and for a time kept his own counsel. Then he gave me a sidelong look and his mouth quirked.

"Give them a year back in the bush and they won't look so good. And they'll be coming to you for medicine and solace. They always have. They always will."

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I stopped and searched his face. It was a good, kindly face.

"You guessed," I said. "Thanks, Eph. It does hurt, though, seeing them get off the shuttle, getting younger all the time. Did you see the way they just melted away—like ice cream—into that mob?"

Ephram nodded and kicked a stone, angling it for a yellow night lizard. He put both hands in his pockets. "And did you notice," he said slowly and carefully, "that Dalvar Sweete wasn't part of that mob?"

"No. Not really."

"Thought not. He left early, just after one of the new arrivals fainted. It seems he took her arm." He gave me a look. "*There's* a man knows pain."

I stopped and looked and glared. "Damn you, Eph! Thanks for the comparison of wounds."

"Nothing meant, Maggie, nothing meant." He smiled and looked innocently off across the landscape and frogged another stone toward the lizard.

"The hell you say." I shivered suddenly in the deepening gloom and contemplated my own plebeian neuroses. I didn't *have* to be lonely, damn it, I *had* been proposed to. Sam Lomberg, one or two others. But I was a misfit. Had been, was, will be. I grasped the nettle and felt a little better for it. There wouldn't be any Lochinvar-from-out-of-the-West. Not for me.

"Come on, Eph," I said. "The light's giving out. Let's go in."

After shuttle-fall things returned to normal. Sick cows, pregnant wives, broken legs. The calls came in over the comm net, the bushlander party-line of survival.

And I rode the circuit, Ephram driving. This one turned out to be an eight-day trip. They were getting longer as the bushlanders pushed the perimeters back. I was happy to have Ephram. He was good company, and a damned good shot, should danger threaten.

Across the ridge there were two cases of breakbone fever, local variety, and an epidemic of jaundice. And, of course, the ever-present cases of heat-stroke, brought on by working too many hours under Palmstar's heavy yellow sun.

We didn't bury anyone that circuit, though two of the new brides looked near to collapse. There was no more envy. I gave them placebos and a warm shoulder to cry on, remembering how it had been when I'd first arrived. It is not a good feeling, that twisting visceral thing that happens when you trade one culture for another. That uprooting process *can* be life-threatening.

Heading back toward town, Ephram sank back into his seat and gave me a grin.

"It was a good run, Maggie. A few pills, a bandage or two—and no caskets to build." He looked out of the air-sled at a long line of dust columns drifting lazily toward the northeast. The columns were harbingers of drought, and with the drought would come a sun to lay upon the ground with a white heat. Difficult times ahead . . . but then, times were always difficult.

We were within sight of town when the intercom sputtered into life.

"Medical emergency! Ephram, Maggie, you tapped in?"

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"I'm here," I said, thumbing the button.

"Thank God! This is Al Walker. My boy is having trouble breathing—his neck is swollen. I've never seen anything like it!" The bushlander's voice was high-pitched, on the ragged edge of hysteria.

"Look at his eyes. Is there a color change?"

"They're bluish—and he's got a fever."

I glanced at Ephram, but he had already put the air-sled into a sixty-degree slide. We headed off toward the south at open throttle, the vehicle whining protestingly at the sudden acceleration.

I punched the speaker button again. "We're on our way, Al. Cool him down with water and look for puncture wounds. Keep his head tilted back." I let go the button and looked at Ephram. "Rock beetle," I said. "He has maybe a fifty-fifty chance if we get to him in the next few hours."

Ephram nodded, his lean face empty of expression. If it was possible for a man to turn to stone, Ephram had done so. I couldn't blame him; he had lost one son to a rock beetle, back in the early days. He had seen more than his share of death and pain and suffering. He would know of Al Walker's hopelessness, as he watched his only son suffocate before him. If he didn't turn us over, we would make it to the outlander's homestead in time.

Two hours later we topped a sandy knoll, and Ephram angled the air-sled between two monoliths of black stone.

"Ten minutes more," he murmured between his teeth. His eyes flicked left and right as his gnarled hands gripped the wheel.

I let out a long breath and grinned with relief. I had been monitoring the boy's progress on the comm net; and barring unforeseen complications, he should pull through. I remembered him well, a small tow-headed youngster of nine summers. Jethro was his name. I had been there at his birth, and, a year later, at his mother's deathbed.

"We're only minutes away," I said into the intercom. "How is he doing?"

"Laboring," Al Walker said. "But holding his own. The cold water seems to have kept down the swelling."

The tracheotomy I performed was not one of my neater efforts, but I doubted if the outlander would complain. His son was breathing easily again, the tube in his neck emitting a reassuring whistle.

"I'll be back this way next week," I said. "In the meantime, do you have any close neighbors, in case of an emergency?"

He gave it some thought. "That Lythian built himself a homestead over west about thirty klicks. He's been here once—and like to scare the pants off Jethro."

I couldn't argue with Jethro's fears. The women off the shuttle had taken one look at him and blanched. It would be a long time before he would find a proper mate.

"We'll stop by and see him," I said. "Even if he doesn't visit, he can keep in touch on the comm net."

We found Dalvar Sweete lifting a stone out of a soon-to-be alfalfa field.

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And oddly, in his own element, he had a grace near to beauty. His leathery body gleamed darkly, the muscles beneath the skin knotting and rippling as they took the stone's weight. The parasols were lifted high, shielding him from the sun's searing heat. One thing to be thankful for—it was unlikely I'd ever have to treat him for heat-stroke.

Catching movement out of the corner of his eyes, he let go the stone and straightened up.

"Afternoon, Maggie. Ephram. What brings you out here?" He raised his eyebrows quizzically, ran horny fingers through his hair.

I explained about Jethro. Without hesitation the Lythian agreed to keep an eye on the Walker homestead.

"Rock beetle, huh?" he said at one point. "I ran into a nest of them myself three days ago."

I looked at him in surprise. His remark had been casual, off-hand, as though dealing with the venomous creatures was not in the least dangerous.

He saw my look and grinned. "They tried to bite me and couldn't—I'm too well protected."

I caught myself then and returned the grin. And wished not for the first time that he wouldn't *do* that.

A fortnight later the wind began to rise, weaving dust clouds into sinuous trailers that hugged the ground and filtered into the buildings to leave a coating of white talc. Bothersome but livable. Tribulations from the mother goddess. Palmstar abides.

Ephram, at least, thought it was serious. He talked with bushlanders all up and down the line, keeping it light, letting them tell it their own way. Then he studied the billowing clouds massing up beyond the town and plotted wind speeds on a topography overlay. "First year I was here the wind blew like this," he said bleakly. "Look here." He pointed to a neat row of figures at the base of the sheet. "There's a constant increase in wind velocity. If that keeps up we'll have a full-blown hurricane by morning."

I felt a deep foreboding. "We've never had hurricanes here," I said. "We're not equipped to handle one."

Ephram grunted, his mouth contracting into a parody of a smile. "Don't worry about us—we can dig in and wait it out. There's lots of food and water, and these buildings were built to last." He stopped and chewed at a knuckle, organizing his thoughts.

"What about the bushlanders?"

"Touch and go," Ephram admitted somberly. "Depending on how long the storm lasts."

I stared out the windows at the dervish-like dust clouds, heard the rattle-pop of small pebbles against the reinforced glass. Crazy damned world! Nineteen years of effort, an eternity of struggle and despair and joy, and it could all be wiped away in the space of seconds.

"How long did that other one last?" I asked without turning. "The first one—the year you made planet-fall."

"Nine days," Ephram said. He came up behind me and put a hand on my shoulder. "But we weren't as tough as these bushers. We hadn't learned how to survive yet."

"How many died?"

"Five. Out of a total of fifteen."

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"Oh, great!" I said sarcastically. And suddenly the hopelessness turned to anger. The planet might kill us, but we'd at least go down fighting. "Two things," I said. "First—get on the comm net and inform everybody we're in for a blow. Second—let's get those nearest town in here where there are some solid buildings."

"Wind's above 160 klicks up on the ridge," Ephram said. He leaned away from the communications console and shook his head tiredly. He had been manning the comm net for five straight hours, and it showed in the haggard lines of his face.

"Is everybody safe?"

He forced a reassuring grin, not even turning his head when something large and hard hammered against the side of the building. "So far. There's a problem, though. The storm is causing interference on the net. I'm not sure how much longer we'll have contact with the outlanders."

I noticed the way his shoulders slumped, and said: "Why don't you get some sleep? I'll get one of the others to watch the net."

Before he could reply the door slammed open with all the force of the storm behind it. A figure, momentarily hidden by the swirl of sand and wind, struggled with the door and finally dogged the latches.

"Doctor! You've got to come. . . !"

The face, white and bloodless, belonged to Tommy Gorski. His family had moved into Nolava to wait out the storm.

"What happened?"

"It's my father. He went outside to move our air-sled—and a tree branch hit him."

I was already reaching for my medikit. I followed Tommy into the shrieking void, linking my arm in his, pushing hard against the fury of the wind.

The elder Gorski had already been put into bed. He was just conscious, in shock, his features drained of blood and clammy to the touch.

The tree branch had done its work well, crushing the upper leg and severing the *rectus femoris*, the long muscle leading to the kneecap. Ray Gorski would be a cripple for the rest of his days. I did all I could with bandages and neo-meperidine and sutures, while outside the wind howled and the talc-like dust spread everywhere.

When I re-entered the office I found Ephram sitting tensely at the communications deck, eyes red-rimmed but alert. He waited until I closed the door, then poured me a cup of coffee from the urn beside the console.

"How is he?"

I shrugged and sipped thankfully from the cup. "He'll never walk normally again—and he has three children. Heavy dues, Eph."

"He's not the only one paying dues." Ephram's mouth turned down grimly and he indicated the console with a jerk of his head. "Three homesteaders and their families are weathering the storm at Arlen's place. They've got contaminated water out there and nine of them are in coma. It looks a lot like myoneural poisoning."

The mother goddess and Murphy's Law. Somehow they had gotten together

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and spawned this mess. I felt numb. I found a chair and sat down, then stared across at Ephram, sharing his sense of *déjà vu*. An epidemic of myoneural poisoning had run rampant through the early settlements, killing one in six. We thought we'd seen the last of it; it killed in a particularly ugly way. The source of the contaminant had ultimately been traced to an aquifer sixty feet beneath bed rock—the site of a newly dug well. If Mike Arlen had tapped into another poisoned aquifer . . . I thrust the thought away as being too ghastly.

"Call Sam Lomberg," I said. "He lives within a few klicks of the Arlen homestead. He'll have to bring them in."

"In this hurricane? With night coming on? Don't be silly—he wouldn't have a chance."

He was right, of course. An air-sled was a dead duck in a windstorm, depending as it did upon ground-effect. Being right didn't help, though.

"Then send out a general call," I said, and recognized desperation in my voice. "To anyone close enough to help. And tell the Arlens I'll be there as soon as the winds die down."

Dawn brought violet shadows that streaked the sky. It lent the harsh landscape a curious beauty. Ghostly and surreal. Our goddess has moods.

But the winds hadn't stopped. If anything, they had picked up. The building creaked and shifted in their grasp, cracking plaster, making light fixtures dance.

The comm net was silent, though at times it crackled. The storm made communication impossible.

I saw the windows through glass that overflowed and shimmered. The noise around me made my bones ache.

"Easy, Maggie, easy," Ephram said, and I realized I was crying.

"Nine people dying, Eph. I never felt so helpless."

He put his hand on my shoulder and squeezed. "As soon as the winds quiet a bit we'll get help out there." His face took on the stony resolute look of an anxious father.

I shook my head. "That will be too late. You can measure their lives in hours—you know what that poison can do."

At noon the winds swung around to the south and blew the roofs off two of the storage buildings at the end of the street. They fluttered by like giant kites. I checked Ray Gorski for the third time, gave him another shot of neo-mep against the pain.

In the middle of the afternoon there was a sound at the door, a dull muffled banging that continued until I leaned against the door, opened it, let in a short stocky figure. I looked at him in amazement, got an open-mouthed grin in return. Dalvar Sweete! With his altered musculature and leathery exterior, he resembled nothing so much as a creature out of prehistory.

"I heard," he said, and shook sand off onto the floor. His head swung half around to take in Ephram, then swept back to me. "On the comm net. You said you needed help."

I found myself staring at him. "God, yes. But the storm . . ."

The grin again, horrific as ever. But yet, this time, it was somehow reassuring. He walked past me and stared out

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the window. "Get ready to go," he said. "We have about half an hour before the winds shift."

I paused for a moment, and then I moved. Providence had brought him—I would use him! I gathered my medical things and shrugged hurriedly into a thick coat.

"Hold on just a minute," Ephram said abruptly. "You're not taking Maggie out in that hurricane. She'll die out there." He balled his hands into fists and took two steps forward to confront the Lythian.

Something welled up in my throat at the sight of the old man challenging Dalvar Sweete. Challenging him over *me*.

The Lythian merely moved his head, looking at me over Ephram's shoulder. "Hurry," he said.

"No, by God!"

I said softly, "Thank you, Eph. But no, go back. I trust him. He'll take care of me."

"How?" Ephram demanded. "The winds are making 200 klicks out there. You won't get twenty meters." He turned to Dalvar Sweete again and his voice took on a new timbre. "How are you going to keep her alive—in weather like this?"

The younger man grinned but did not answer. Instead he swung past and took me by the arm. His eyes burned darkly.

"Do you have a blanket?"

"Y-yes, over there on the cot."

"Get it."

When he had the blanket he opened it fully, wrapped it around me, then lifted me as if I weighed nothing.

"Open the door," he told Ephram.

When he hesitated, I said: "Please, Eph."

Then there was wind, a shrieking maelstrom that caught at us and drove us forward.

I closed my eyes, then opened them. One of the storage buildings, roofless, had begun to sway and twist. A sudden gust swept it away altogether. The ground wind was intense, driving sand and stones before it. Gripping me tighter, grinning, Dalvar Sweete raised his useless parasols and let the winds surge beneath them. Those wings, non-functional normally, were now in a 200-klick gale.

We lifted and the air seared us with its power. We were flung upward as though from a giant catapult. Below, the blown sands took on the aspect of currents in a stream.

I swallowed, trying to work up some moisture on my tongue. I got blood instead. I glanced up, but the Lythian's face was tightly drawn, intent. I closed my eyes and counted to ten by listening to the thuds of my heart.

With a hurricane as a tailwind we made good time. Still, it required an almost superhuman skill to maneuver through the morass of downdrafts and uprisings. I clutched my medicine bag and marveled.

The Arlen homestead lay to the southeast, requiring us to quarter down against the wind. Lack of reference points made us seek out isolated mountain peaks, surge higher to catch glimpses of Palmstar's yellow sun.

Half an hour later we descended, feeling first the ferocity of the ground winds, then a sledgehammer shock as we struck and rolled. Moments later I

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was dragged, dry-mouthed and trembling, into the lee of a rocky overhang.

"Are you all right?" Dalvar Sweete was kneeling over me. There was worry on his saturnine features. With the wind howling around him, he resembled more than ever a demon in his element.

I looked back at him and forced a grin. I said, "Ye gods! What a flying carpet service!"

He looked relieved, then he lifted his head over the protecting rock and ducked it down again. "I think the homestead is about a klick from here. North. Against the wind. Can you manage?"

I shrugged free of the blanket and stood up. "With your help," I said. "There doesn't seem to be anything broken."

He offered his arm in a strangely quixotic old-world gesture. I took it, feeling suddenly euphoric, as though the world had righted itself after being turned upside down.

Myoneural poisoning yields before a properly administered drug series as storms yield to the uncertain rhythms of a planet. This once the goddess relented. The hurricane trailed off, vanishing into the desert to the south. And, in three days, the stricken outlanders were sitting up, demanding my full attention.

I went back to Nolava in Mike Arlen's air-sled. Dalvar Sweete drove, his parasols lifted so they wouldn't catch the seats. Several times I caught him looking at me, his eyes glowing darkly.

"Maggie," he said. I already knew the question he would ask.

But I didn't know until he asked it what my answer would be.

Two misfits.

We spent our honeymoon just off the coast of the western sea, where the rocks are worn round and smooth.

I understand they have lovely hurricanes there this time of year. ■

● Any engineer or technician does well to understand the system he's working on before he tries to fix it—a requirement which is perhaps especially important, and especially difficult to satisfy, when the system in question is an entire planet's ecosystem. In our next issue's cover story, "Guardians," George R.R. Martin's ecological engineer Haviland Tuf returns to *Analog*'s pages, offering his services to a planet named Namor, which is having a little problem with sea monsters—*lots* of sea monsters. There's a perfectly simple explanation, of course, and a correspondingly simple cure. But the folks on Namor want their problem solved *now*, and Tuf quickly learns that an impatient customer can be a least as big a problem as a plague of sea monsters. The customer, in turn, learns that certain principles of business are invariant over long spans of history....

The fact article, by Walter B. Hendrickson, Jr., is a timely follow-up on the maiden voyage of space shuttle *Columbia*. Most of us are glad it finally happened, but why did it take so long—and what can we learn from the experience that might help us in the future? The problems, it seems, were not purely technical; Hendrickson's title is "Penny Wise, Pound Foolish."

And then we'll have Part Two of David Bischoff and Thomas F. Monteleone's *Dragonstar*, plus a diversity of stories by writers both familiar and new.

IN TIMES TO COME

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biolog

By Jay Kay Klein

Edward A. Byers

The April 1979 *Analog* stands likely to become one of the particularly famous issues of this magazine. In retrospect, that month's lineup of authors has proved to include many of those helping this magazine in particular, and science fiction in general, enter what promises to be another golden age. Edward A. Byers had his first story in this issue, along with the first by Michael McCollum (detailed in a previous "Biolog").

Ed thus joined Paul Nahin, Kirill Bulychev (a Russian famous not only for science fiction in the USSR but also under another name for Oriental studies), Gregory Benford, Somtow Sucharitkul, Thomas Sullivan, and John Varley. And this issue further contained the justly famous George Harper article, "Build Your Own A-Bomb and Wake Up the Neighborhood."

"Pathway" drew upon Ed's interest in archeology, which has led him into volunteer field dig work. Other influences in what became the first of the Pan Kirst series can be traced to his education and some very specialized jobs. He received a BA *from Defiance College in Defiance*, Ohio, and MA in Psychology from Ball State University in Muncie, Indiana. Later he became a cryptographer with the United States Army. He has also been a newspaperman and a quality assurance engineer in the automotive industry, as well as holding other jobs before entering his present full-time occupation: engineering writer in the military-industrial complex of the Washington, D.C., area.

Although Ed had dabbled in writing previously, his determination to become serious firmed in 1977 at a writer's workshop, where he met—and was encouraged by—science fiction writer Joe Hensley. From an early date, many of the famous writers in the field had captured his admiration, especially Philip José Farmer, Theodore Sturgeon, A. Merritt, and Edgar Pangborn.

Ed remains interested in experimental psychology, and is particularly fascinated by Man's two-part brain structure with its complex memory and data-handling processes. Beyond this, human imagination and technological ingenuity in the field of space exploration is a special preoccupation. In contrast, he wonders how so many high-ranked political figures could have so failed in imagination that they have emasculated and backburnered what should be a national priority. He thinks this blindness to what should be our manifest destiny in space is absolutely monumental, and fears that history may exact a heavy penalty from us, as it has from previous cultures that faltered on the path to greatness. As for himself, Ed thinks one of his great thrills was working in a NASA research project to determine gas effects at high altitudes. ■

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Joe Haldeman

A !TANGLED WEB

Doing business with aliens
will undoubtedly
create novel problems.
And shrewd practitioners
will just as undoubtedly
find useful invariants....

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Your spaceport bars fall into two distinct groups: the ones for the baggage and the ones for the crew. I was baggage, this trip, but didn't feel like paying the prices that people who space for fun can afford. The Facilities Directory listed under "Food and Drink" four establishments: The Hartford Club (inevitably), The Silver Slipper Lounge, Antoine's, and Slim Joan's Bar & Grill.

I went to a currency exchange booth first, assuming that Slim Joan was no better at arithmetic than most bartenders, and cashed in a hundredth-share of Hartford stock. Then I took the drop-lift down to the bottom level. That the bar's door was right at the drop-lift down to the exit would be a dead giveaway even if its name had been The Bell, Book, and Candle. Baggage don't generally like to fall ten stories, no matter how slowly.

It smelled right, stir-fry and stale beer, and the low lighting suggested economy rather than atmosphere. Slim Joan turned out to be about a hundred thousand grams of transvestite. Well, I hadn't come for the scenery.

The clientele seemed about evenly mixed between humans and others, most of the aliens being !tang, since this was Alberio III. I've got nothing against the company of aliens, but if I was going to spend all next week wrapping my jaws around !tangish, I preferred to mix my drinking with some human tongue.

"Speak English?" I asked Slim Joan.

"Some," he/she/it growled. "You would drink something." I'd never heard a Russian-Brooklyn accent before. I ordered a double saki, cold, in Russian, and took it to an empty booth.

One of the advantages of being a Hartford interpretor is that you can order a drink in a hundred different languages and dialects. Saves money; they figure if you can speak the lingo you can count your change.

I was freelancing this trip, though, working for a real-estate cartel that wanted to screw the !tang out of a few thousand square kilometers of useless seashore property. It wouldn't stay useless, of course.

Alberio III is a real garden of a planet, but most people never see it. The tachyon nexus is down by Alberio I, which we in the trade refer to as "Armpit," and not many people take the local hop out to III (Armpit's the stopover on the Earth-Sammler run). Starlodge, Limited, was hoping to change that situation.

I couldn't help eavesdropping on the !tangs behind me. (I'm not a snoop; it's a side effect of the hypnotic-induction learning process.) One of them was leaving for Earth today, and the other was full of useful advice. "He"—they have seven singular pronoun classes, depending on the individual's age and estrous condition—was telling "her" never to make any reference to human body odor, no matter how vile it may be. He might also tell her not to breathe on anyone. One of the byproducts of their metabolism was butyl nitrite, which smells like well-aged socks and makes humans get all faint and cross-eyed.

I've worked with !tangs a few times before, and they're some of my favorite people. Very serious, very honest, and their logic is closer to human logic than most. But they *are* strange-looking. Imagine a perambulating haystack with an elephant trunk protruding. They have

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two arms under the pile of yellow hair, but it's impolite to take them out in public unless one is engaged in physical work. They do have sex in public, constantly, but it takes a zoologist with a magnifying glass to tell when.

He wanted her to bring back some Kentucky bourbon and Swiss chocolate. Their metabolism parts company with ours over proteins and fats, but they love our carbohydrates and alcohol. The alchohol has a psychedelic sort of effect on them, and sugar leaves them plastered.

A human walked in and stood blinking in the half-light. I recognized him and shrank back into the booth. Too late.

He strode over and stuck out his hand. "Dick Navarro!"

"Hello, Pete." I shook his hand once. "What brings you here? Hartford business?" Pete was also an interpreter.

—Oh, no, he said in Arabic. —Only journeying.

—Knock it off, I said in Serbo-Croatian. —Isn't your native language English? I added in Greek.

"Sure it is. Yours?"

"English or Spanish. Have a seat." I smacked my lips twice at Slim Joan, and she came over with a menu. "To be eating you want?"

"Nyet," he said. "Vodka." I told her I'd take another.

"So what are you doing here?" Pete asked.

"Business."

"Hartford?"

"Nope."

"Secret."

"That's right." Actually, they hadn't said anything about it being secret. But I knew Peter Lafitte. He wasn't just passing through.

We both sat silently for a minute, listening to the !tangs. We had to smile when he explained to her how to decide which public bathroom to use when. This was important to humans, he said. Slim Joan came with the drinks and Pete paid for both, a bad sign.

"How did that Spica business finally turn out?" he asked.

"Badly." Lafitte and I had worked together on a partition-of-rights hearing on Spica IV, with the Confederación actually bucking Hartford over an alien-rights problem. "I couldn't get the humans to understand that the minerals had souls, and I couldn't get the natives to believe that refining the minerals didn't affect their spiritual status. It came to a show of force and the natives backed down. I wouldn't like to be there in twenty years, though."

"Yeah. I was glad to be recalled. Arcturus all over."

"That's what I tried to tell them." Arcturus wasn't a regular stop any more, not since a ship landed and found every human artistically dismembered. "You're just sight-seeing?"

"This has always been one of my favorite planets."

"Nothing to do."

"Not for you city boys. The fishing is great, though."

Ah ha. "Ocean fishing?"

"Best in the Confederación."

"I might give it a try. Where do you get a boat?"

He smiled and looked directly at me. "Little coastal village, Pa'an!al."

Smack in the middle of the tribal ter-

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ritory I'd be dickering for. I dutifully repeated the information into my ring.

I changed the subject and we talked about nothing for a while. Then I excused myself, saying I was time-lagging and had to get some sleep. Which was true enough, since the shuttle had stayed on Armpit time, and I was eight hours out of phase with III. But I bounced straight to the Hartford Courier office.

The courier on duty was Estelle Dorring, whom I knew slightly. I cut short the pleasantries. "How long to get a message to Earth?"

She studied the clocks on the wall. "You're out of luck if you want it hand-carried. I'm not going to Armpit until tomorrow. Two days on the shuttle and I'll miss the Earth run by half-a-day.

"If broadcast is all right, you can beam to Armpit and the courier there can take it along on the Twosday run. That leaves in 72 minutes. Call it 19 minutes' beam time. You know what you want to say?"

"Yeah. Set it up." I sat down at the customers' console.

STARLODGE, LIMITED
642 EASTRIVER
NEW YORK, NEW YORK 100992
ATTENTION: PATRICE DUVAL

YOU MAY HAVE SOME COMPETITION HERE. NOTHING OPEN YET, BUT A GUY WE CALL PETER RABBIT IS ON THE SCENE. CHECK INTERPRETERS GUILD AND SEE WHO'S PAYING PETER LAFITTE. CHANGE TERMS OF SALE? PLEASE REPLY NEXT SAMMLER RUN—RICARDO NAVARRO/RM 2048/ ALBERIO HILTON.

I wasn't sure what good the information would do me, unless they also found out how much he was offering and authorized me to outbid him. At any rate, I wouldn't hear for three days, earliest. Sleep.

Alberio III—its real name is !ka'al—rides a slow sweeping orbit around Alberio A, the brighter of the two suns that make up the Alberio system (Alberio A is a close double star itself, but its white dwarf companion hugs so close that it's lost in the glare). At this time of day, Alberio B was visible low in the sky, a hard blue diamond too bright to stare at, and A was right overhead, a bloated golden ball. On the sandy beach below us the flyer cast two shadows, dark blue and faint yellow, which raced to come together as we landed.

Pa'an!al is a fishing village thousands of years old, on a natural harbor formed where a broad jungle river flows into the sea. Here on the beach were only a few pole huts with thatched roofs, where the fishers who worked the surf and shallow pools lived. Pa'an!al proper was behind a high stone wall, which protected it on one side from the occasional hurricane, and on the other from the interesting fauna of the jungle.

I paid off my driver and told him to come back at second sundown. I took a deep breath and mounted the steps. There was an open-cage Otis elevator beside the stairs, but people didn't use it, only fish.

The !tang are compulsive about geometry. This wall was a precise 1:2 rectangle, and the stairs mounted from one corner to the opposite in a satisfyingly Euclidian thirty degrees. A guardrail

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would have spoiled the harmony. The stairs were just wide enough for two !tang to pass, and the rise of each step was a good half-meter. By the time I got to the top I was both tired and slightly terrified.

A spacefaring man shouldn't be afraid of heights, and I'm not, so long as I'm in a vehicle. But when I attained the top of the wall and looked down the equally long and perilous flight of stairs to the ground level, I almost swooned. Why couldn't they simply have left a door in the wall?

I sat there for a minute and looked down at the small city. The geometrical regularity *was* pleasing. Each building was either a cube or a stack of cubes, and the rock from which the city was built had been carefully sorted, so that each building was a uniform shade. They went from white marble through sandy yellow and salmon to pearly gray and obsidian. The streets were a regular matrix of red brick. I walked down, hugging the wall.

At the bottom of the steps a !tang sat on a low bench, watching the nonexistent traffic. —Greetings, I clicked and snorted at him, —it certainly is a pleasant day.

—Not everywhere, he grunted and wheezed back. An unusually direct response.

—Are you waiting for me?

—Who can say? I am waiting. His trunk made a philosophical circle in the air. —If you had not come, who knows for what I would have been waiting?

—Well that's true, that's true. He made a circle in the other direction, which I think meant What else? I stood there for a minute while he looked at me or the ground or the sky. You could never tell.

—I hope this isn't a rude question, he said. —Will you forgive me if this is a rude question?

—I certainly will try.

—Is your name !ica'o !va!o?

That was admirably close. —It certainly is.

—You could follow me. He got up. —Or enjoy the pleasant day.

I followed him closely down the narrow street. If he got in a crowd I'd lose him for sure. I couldn't tell an estrous-four female from a neuter, not having sonar (they tell each other apart by sensing body cavities, very romantic).

We went through the center of town, where the well and the market square were. A few dozen !tang bargained over food, craft items, or abstractions. They were the most mercantile race on the planet, although they had sidestepped the idea of money in favor of labor-equivalence: for those two ugly fish I will trade you an original sonnet about your daughter and three vile limericks for your next affinity-group meeting. Four limericks, tops.

We went into a large white building that might have been City Hall. It was evidently guarded, at least symbolically, since two !tang stood by the door with their arms exposed.

It was a single large room similar to a Terran mosque, with a regular pattern of square columns holding up the ceiling. The columns supported shelving in neat squares, up to about two meters; on the shelves were neat stacks of accordion-style books. Although the ceiling had inset squares of glass that gave adequate light, there was a strong smell

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of burnt fish oil, which meant the building was used at night. (We had introduced them to electricity, but they used it only for heavy machinery and toys.)

The !tang led me to the farthest corner, where a large haystack was bent over a book, scribbling. They had to read or write with their heads a few centimeters from the book, since their light-eyes were only good for close work.

—It has happened as you foretold, Uncle. (Not too amazing a prophecy, as I'd sent a messenger over yesterday.)

Uncle waved his nose in my direction. —Are you the same one who came four days ago?

—No. I have never been to this place. I am Ricardo Navarro, from the Starlodge tribe.

—I grovel in embarrassment. Truly it is difficult to tell one human from another. To my poor eyes you look exactly like Peter Lafitte.

(Peter Rabbit is bald and ugly, with terrible ears. I have long curly hair with only a trace of grey, and women have called me attractive.) —Please do not be embarrassed. This is often true when different peoples meet. Did my brother say what tribe he represented?

—I die. O my hair falls out and my flesh rots and my bones are cracked by the hungry ta!a'an. He drops me behind him all around the forest and nothing will grow where his excrement from my marrow falls. As the years pass the forest dies from the poison of my remains. The soil washes into the sea and poisons the fish, and all die. O the embarrassment.

—He didn't say?

—He did but said not to tell you.

That was that. —Did he by some chance say he was interested in the small morsel of land I mentioned to you by courier long ago?

—No, he was not interested in the land.

—Can you tell me what he was interested in?

—He was interested in *buying* the land.

Verbs. —May I ask a potentially embarrassing question?

He exposed his arms. —We are businessmen.

—What were the terms of his offer?

—I die. I breathe in and breathe in and cannot exhale. I explode all over my friends. They forget my name and pretend it is dung. They wash off in the square and the well becomes polluted. All die. O the embarrassment.

—He said not to tell me?

—That's right.

—Did you agree to sell him the land?

—That is a difficult question to answer.

—Let me rephrase the question: is it possible that you might sell the land to my tribe?

—It is possible, if you offer better terms. But only possible, in any case.

—This is embarrassing. I, uh, die and, um, the last breath from my lungs is a terrible acid. It melts the seaward wall of the city and a hurricane comes and washes it away. All die. O the embarrassment.

—You're much better at that than he was.

—Thank you. But may I ask you to amplify as to the possibility?

—Certainly. Land is not a fish or an elevator. Land is something that keeps you from falling all the way down. It

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gives the sea a shore and makes the air stop. Do you understand?

—So far. Please continue.

—Land is like time but not in a mercantile sense. I can say "In return for the time it takes me to decide which one of you is the guilty party, you must give me such-and-so." But how can I say "In return for the land I am standing on you must give me this-and-that"? Nobody can step off the time, you see, but I can step off the land, and then what is it? Does it even exist? In a mercantile sense? These questions and corrolaries to them have been occupying some of our finest minds ever since your courier came long ago.

—May I make a suggestion?

—Please do. Anything might help.

—Why not just sell it to the tribe that offers the most?

—No, you don't see. Forgive me, you Terrans are very simple-minded people, for all your marvelous Otis elevators and starships (this does not embarrass me to say because it is meant to help you understand yourself; if you were !tang you would have to pay for it). You see, there are three mercantile classes. Things and services may be of no worth, of measurable worth, or of infinite worth. Land has never been classified before, and it may belong in any of the categories.

—But Uncle! The Lafitte and I have offered to buy the land. Surely that eliminates the first class.

—O you poor Terran. I would hate to see you try to buy a fish. You must think of all the implications.

—I die. I, uh, have a terrible fever in my head and it gets hotter and hotter until my head is a fire, a forge, a star. I set the world on fire and everybody dies. O the embarrassment. What implications?

—Here is the simplest. If the land has finite value, when at best all it does is keep things from falling all the way down, how much is air worth? Air is necessary for life, and it makes fires burn. If you pay for land do you think we should let you have air for free?

—An interesting point, I said, thinking fast and !tangly. —But you have answered it yourself. Since air is necessary for life it is of infinite value, and not even one breath can be paid for with all the riches of the universe.

—O poor one, how can you have gotten through life without losing your feet? Air would be of infinite worth thus only if *life* were of infinite worth, and even so little as I know of your rich and glorious history proves conclusively that you place very little value on life. Other people's lives, at any rate. Sad to say, our own history contains a similarly bonehungry period.

—Neither are we that way now, Uncle.

—I die. My brain turns to hungry maggots. . . .

I talked with Uncle for an hour or so, but got nothing out of it save a sore soft palate. When I got back to the hotel there was a message from Peter Lafitte, asking whether I would like to join him at Antoine's for dinner. No, I would not *like* to, but under the circumstances it seemed prudent. I had to rent a formal tunic from the bellbot.

Antoine's has all the *joie de vivre* of a frozen halibut, which puts it on a par with every other French restaurant off

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Earth. We started with an artichoke *vinaigrette* that should have been left to rot in the hydroponics tank. Then a filet of "beef" from some local animal that I doubt was even warmblooded. All this served by a waiter who was a Canadian with a fake Parisian accent.

But we also had a bottle of phony Pouilly-Fuisse followed by a bottle of ersatz Burgundy followed by a bottle of snythetic Chateau-d'Yquem. Then they cleared the table and set a bottle of brandy between us, and the real duel began. Short duel, it turned out.

"So how long is your vacation going to last?" I made a gesture that was admirably economical. "Not long at these prices."

"Well, there's always Slim Joan's." He poured himself a little brandy and me a lot. "How about yourself?"

"Ran into a snag," I said. "Have to wait until I hear from Earth."

"They're not easy to work with, are they?"

"Terrans? I'm one myself."

"The !tang, I mean." He stared into his glass and swirled the liquor. "Terrans as well, though. Could I set to you a hypothetical proposition?"

"My favorite kind," I said. The brandy stung my throat.

"Suppose you were a peaceable sort of fellow."

"I am." Slightly fuzzy, but peaceable.

"And you were on a planet to make some agreement with the natives."

I nodded seriously.

"Billions of bux involved. Trillions."

"That would really be something," I said.

"Yeah. Now further suppose that there's another Terran on this planet who, uh, is seeking to make the same sort of agreement."

"Must happen all the time."

"For trillions, Dick? Trillions?"

"Hyp'thetical trillions." Bad brandy, but strong.

"Now the people who are employing you are ab—solute—ly ruthless."

"*Ma!ryso'ta*," I said, the !tang word for "bonehungry." Close to it, anyhow.

"That's right." He was starting to blur. More wine than I'd thought. "Stop at nothing. Now how would you go about warning the other Terran?"

My fingers were icy cold and the sensation was crawling toward my elbows. My chin slipped off my hand and my head was so heavy I could hardly hold it up. I stared at the two fuzzy images across the table. "Peter." The words came out slowly, and then not at all: "You aren't drinking. . . ."

"Terrible brandy, isn't it." My vision went away, although it felt as if my eyes were still open. I heard my chin hit the table.

"Waiter?" I heard the man come over and make sympathetic noises. "My friend has had a little too much to drink. Would you help me get him to the bellbot?" I couldn't even feel them pick me up. "I'll take this brandy. He might want some in the morning." Jolly.

I finally lapsed into unconsciousness while we were waiting for the elevator, the bellbot lecturing me about temperance.

I woke up the next afternoon on the cold tile floor of my suite's bathroom.

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I felt like I had been taken apart by an expert surgeon and reassembled by an amateur mechanic. I looked at the tile for a long time. Then I sat for a while and studied the interesting blotches of color floating between my eyes and my brain. When I thought I could survive it, I stood up and took four Hangaways.

I sat and started counting. Hangaways hit you like a piledriver. At eighty the adrenaline shock came. Tunnel vision and millions of tiny needles being pushed out through your skin. Rivers of sweat. Cathedral bells tolling, your head the clapper. Then the dry heaves and it was over.

I staggered to the phone and ordered some clear soup and a couple of cold beers. Then I stood in the shower and contemplated suicide. By the time the soup came I was contemplating homicide.

The soup stayed down and by the second beer I was feeling almost human, Neanderthal anyhow. I made some enquiries. Lafitte had checked out. No shuttle had left, so he was either still on the planet or he had his own ship, which was possible if he was working for the outfit I suspected he was working for. I invoked the holy name of Hartford, trying to find out to whom his expenses had been billed. Cash.

I tried to order my thoughts. If I reported Lafitte's action to the Guild he would be disbarred. Either he didn't care, because They were paying him enough to retire in luxury—for which I knew he had a taste—or he actually thought I was not going to get off the planet alive. I discarded the dramatic second notion. Last night he could have more easily killed me than warned me. Or had he actually *tried* to kill me, the talk just being insurance in case I didn't ingest a fatal dose? I had no idea what the poison could have been. That sort of knowledge isn't relevant to my line of work.

I suppose the thoroughly rational thing would have been to sit tight and let him have the deal. The fortunes of Starlodge were infinitely less important to me than my skin. He could probably offer more than I, anyhow.

The phone chimed. I thumbed the vision button and a tiny haystack materialized over the end table.

—Greetings. How is the weather?

—Indoors, it's fine. Are you Uncle?

—Not now. Inside the Council Building I am Uncle.

—I see. Can I perform some worthless service for you?

—For yourself, perhaps.

—Pray continue.

—Our Council is meeting with the Lafitte this evening, with the hope of resolving this question about the mercantile nature of land. I would be embarrassed if you did not come too. The meeting will be at *ala'ang in the Council Building.

—I would not cause you embarrassment. But could it possibly be postponed?

He exposed his arms. —We are meeting.

He disappeared and I spent a few minutes translating *ala'ang into human time. The !tang divide their day into a complicated series of varying time intervals depending on the position of the suns and state of appetite and estrous condition. Came to a little before ten o'clock, plenty of time.

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I could report Lafitte, and probably should, but decided I'd be safer not doing so, retaining the threat of exposure for use as a weapon. I wrote a brief description of the situation—and felt a twinge of fear on writing the word "Syndicate"—and sealed it in an envelope. I wrote the address of the Hartford Translators' Guild across the seal and bounced up to the courier's office.

Estelle Dorring stared at me when I walked into the office. "Ricardo! You look like a corpse warmed over."

"Rough night," I said. "Touch of food poisoning."

"I never eat that Tang stuff."

"Good policy." I set the envelope in front of her. "I'm not sure whether to send this or not. If I don't come get it before the next shuttle, take it to Armpit and give it to the next Earth courier."

She nodded slowly and read the address. "Why so mysterious?"

"Just a matter of Guild ethics. I wanted to write it down while it was still fresh. Uh . . ." I'd never seen a truly penetrating stare before. "But I might have more information tonight that would invalidate it."

"If you say so, Ricardo." She slipped the envelope into a drawer. I backed out mumbling something inane.

Down to Slim Joan's for a sandwich of stir-fried vegetables in Syrian bread. Slightly rancid and too much curry, but I didn't dare go to the Council meeting on an empty stomach. !tang sonar would scan it and they would make a symbolic offer of bread, which couldn't be refused. Estelle was partly right about "Tang" food: one bite of the bread contained enough mescaline to make you see interesting things for hours. I'd had enough of that for a while.

I toyed with the idea of taking a weapon. There was a rental service in the pharmacy, to accommodate the occasional sporting type, and I could pick up a laser or a tranquilizer there. But there would be no way to conceal it from the !tang sonar. Besides, Lafitte isn't the kind of person who would employ direct violence.

But if it actually were the Syndicate behind Lafitte, they might well have sent more than one person here; they certainly could afford it. A hitter. But then why would Lafitte set up the elaborate poisoning scene? Why not simply arrange an accident?

My feet were taking me toward the pharmacy. Wait. Be realistic. You haven't fired a gun in twenty years. Even then, you couldn't hit the ground with a rock. If it came to a burnout, you'd be the one who got crisped. Better to leave their options open.

I decided to compromise. There was a large clasp-knife in my bag, that would at least help me psychologically. I went back up to my room.

I thumbed the lock and realized that the cube I'd heard playing was my own. The door slid open and there was Lafitte, lounging on my sofa, watching an old movie.

"Dick. You're looking well."

"How the hell did you get in here?"

He held up his thumb and stripped a piece of plastic off the fleshy part. "We have our resources." He sat up straight. "I hear you're taking a flyer out to Pa'an!al. Shall we divide the cost?"

There was a bottle of wine in a bucket of ice at his feet. I got a glass out of the

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bathroom and helped myself. "I suppose you charged this to my room." I turned off the cube.

He shrugged. "You poked me for dinner last night, *mon frère*. Passing out like that."

I raised the glass to my lips, flinched, and set it down untouched. "Speaking of resources, what was in that brandy? And who are these resourceful friends?"

"The wine's all right. You seemed agitated; I gave you a calmative."

"A *horse* calmative! Is it the Syndicate?"

He waved that away. "The Syndicate's a myth. You—"

"Don't take me for an idiot. I've been doing this for almost as long as you have." Every ten years or so there was a fresh debunking. But the money and bodies kept piling up.

"You have indeed." He concentrated on picking at a hangnail. "How much is Starlodge willing to pay?"

I tried not to react. "How much is the Syndicate?"

"If the Syndicate existed," he said carefully, "and if it were they who had retained me, don't you think I would try to use that fact to frighten you away?"

"Maybe not directly—last night, you said 'desperate men'."

"I was drunk." No, not Peter Rabbit, not on a couple of bottles of wine. fi I just looked at him. "All right," he said, "I was told to use any measures short of violence—"

"Poisoning isn't violence?"

"Tranquilizing, not poisoning. You couldn't have died." He poured himself some wine. "Top yours off?"

"I've become a solitary drinker."

He poured the contents of my glass into his. "I might be able to save you some trouble, if you'll only tell me what terms—"

"A case of Jack Daniels and all they can eat at Slim Joan's."

"That might do it," he said unsmilingly, "but I can offer 1500 shares of Hartford."

That was 150 million dollars, half again what I'd been authorized. "Just paper to them."

"Or a million cases of booze, if that's the way they want it." He checked his watch. "Isn't our flyer waiting?"

I supposed it would be best to have him along, to keep an eye on him. "The one who closes the deal pays for the trip?"

"All right."

On the hour-long flyer ride I considered various permutations of what I could offer. My memory had been jammed with the wholesale prices of various kinds of machinery, booze, candy, and so forth, along with their mass and volume, so I could add in the shipping costs from Earth to Armpit to Alberio III. Lafitte surely had similar knowledge; I could only hope that his figure of 1500 shares was a bluff.

(I had good incentive to bargain well. Starlodge would give me a bonus of up to ten percent of the difference between a thousand shares and whatever the settlement came to. If I brought it in at 900, I'd be a millionaire.)

We were turning inland; the walls of of the city made a pink rectangle against the towering jungle. I tapped the pilot on the shoulder. "Can you land inside the city?"

"Not unless you want to jump from

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.the top of a building. I can set you on the wall, though." I nodded.

"Can't take the climb, Dick? Getting old?"

"No need to waste steps." The flyer was a little wider than the wall, and it teetered as we stepped out. I tried to look just at my feet.

"Beautiful from up here," Lafitte said. "Look at that sunset." Half the large sun's disk was visible on the jungle horizon, a deeper red than Earth's Sun ever shone. The bloody light stained the surf behind us purple. It was already dark in the city below; the smell of rancid fish oil burning drifted up to us.

Lafitte managed to get the inside lane of the staircase. I tried to keep my eyes on him and the wall as we negotiated the high steps.

"Believe me," he said (a phrase guaranteed to inspire trust), "it would make both our jobs easier if I could tell you who I'm representing. But I really am sworn to secrecy."

An oblique threat deserves an oblique answer: "You know I can put you in deep trouble with the Standards Committee. Poisoning a Guild brother."

"Your word against mine. And the bellbot's, the headwaiter's, the wine steward's . . .you did have quite a bit to drink."

"A couple of bottles of wine won't knock me out."

"Your capacity is well known. I don't think you want a hearing investigating it, though, not at your age. Two years 'til retirement?"

"Twenty months."

"I was rounding off," he said. "Yes, I did check. I wondered whether you might be in the same position as I am. My retirement's less than two months away; this is my last big-money job. So you must understand my enthusiasm."

I didn't answer. He wasn't called Rabbit for lack of "enthusiasm."

As we neared the bottom, he said, "Suppose you weren't to oppose me too vigorously. Suppose I could bring in the contract at a good deal less than—"

"Don't be insulting."

In the dim light from the torches sputtering below I couldn't read his expression. "Ten percent of my commission wouldn't be insulting."

I stopped short; he climbed down another step. "I can't believe even *you*—"

"*Verdad*. Just joking." He laughed unconvincingly. "Everyone knows how starchy you are, Dick. I know better than most." I'd fined him several times during the years I was head of the Standards Committee.

We walked automatically through the maze of streets, our guides evidently having taken identical routes. Both of us had eidetic memories, of course, that being a minimum prerequisite for the job of interpreter. I was thinking furiously. If I couldn't out-bargain the Rabbit I'd have to somehow finesse him. Was there anything I knew about the !tang value system that he didn't? Assuming that this Council would decide that land was something that could be bought and sold.

I did have a couple of interesting proposals in my portfolio, that I'd written up during the two-week trip from Earth. I wondered whether Lafitte had seen them. The lock didn't appear to have been tampered with, and it was the old-fashioned magnetic key type. You can pick it but it won't close afterwards.

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We turned a corner and there was the Council Building at the end of the street, impressive in the flickering light, its upper reaches lost in darkness. Lafitte put his hand on my arm, stopping. "I've got a proposition."

"Not interested."

"Hear me out, now; this is straight. I'm empowered to take you on as a limited partner."

"How generous. I don't think Starlodge would like it."

"What I *mean* is Starlodge. You hold their power of attorney, don't you?"

"Unlimited, on this planet. But don't waste your breath; we get an exclusive or nothing at all." Actually, the possibility had never been discussed. They couldn't have known I was going into a competitive bidding situation. If they had, they certainly wouldn't have sent me here slow freight. For an extra fifty shares I could have gone first class and been here a week before Peter Rabbit; could have sewn up the thing and been headed home before he got to Armpit.

Starlodge had a knack for picking places that were about to become popular—along with impressive media power, to make sure they did—and on dozens of worlds they did have literally exclusive rights to tourism. Hartford might own a spaceport hotel, but it wasn't really competition, and they were usually glad to hand it over to Starlodge anyhow. Hartford, with its ironclad lock on the tachyon drive, had no need to diversify.

There was no doubt in my mind that this was the pattern Starlodge had in mind for Alberio III. It was a perfect setup, the beach being a geological anomaly: there wasn't another decent spot for a hotel within two thousand kilometers of the spaceport. Just bleak mountaintops sprouting occasionally out of jungles full of large and hungry animals. But maybe I could lead the Rabbit on. I leaned up against a post that supported a guttering torch. "At any rate, I certainly couldn't consider entering into an agreement without knowing who you represent."

He looked at me impassively for a second. "Outfit called A.W. Stoner Industries."

I laughed out loud. "Real name, I mean." I'd never heard of Stoner, and I do keep in touch.

"That's the name I know them by."

"No concern not listed in *Standard, Poor and Tueme* could come up with nine figures for extraterrestrial real estate speculation. No legitimate concern, I mean."

"There you go again," he said mildly. "I believe they're a coalition of smaller firms."

"I don't. Let's go."

Back in my luggage I had a nasal spray that deadened the sense of smell. Before we even got inside, I knew I should have used it.

The air was grey with fish-oil smoke, and there were more than a hundred !tang sitting in neat rows. I once was treated to a "fish kill" in Texas, where a sudden ecological disaster had resulted in windrows of rotting fish piled up on the beach. This was like walking along that beach using an old sock for a muffler. By Lafitte's expression, he was also unprepared. We both walked forward with slightly greenish cheerfulness.

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A !tang in the middle of the first row stood up and approached us. —Uncle? I ventured, and he waved his snout in affirmation.

—We have come to an interim decision, he said.

—Interim? Lafitte said. —Were my terms unacceptable?

—I die. My footprints are cursed. I walk around the village not knowing that all who cross where I have been will stay in estrous zero, and bear no young. Eventually, all die. O the embarrassment. We want to hear the terms of Navarro's tribe. Then perhaps a final decision may be made.

That was frighteningly direct. I'd tried for an hour to tell him our terms before, but he'd kept changing the subject.

—May I hear the terms of Lafitte's tribe? I asked.

—Certainly. Would Lafitte care to state them, or should I?

—Proceed, Uncle, Lafitte said, and then in Spanish, "Remember the possibility of a partnership. If we get to haggling . . ."

I stopped listening to Rabbit as Uncle began a long litany of groans, creaks, pops, and whistles. I kept a running total of wholesale prices and shipping costs. Bourbon, rum, brandy, gin. Candy bars, raw sugar, honey, pastries. Nets, computers, garbage composters, water purifying plant, hunting weapons. When he stopped, I had a total of only H620.

—Your offer, Navarro? Could it include these things as a subset?

I had to be careful. Lafitte was probably lying about the 1500, but I didn't want to push him so hard he'd be able to go over a thousand on the next round. And I didn't want to bring out my big guns until the very end.

—I can offer these things and three times the specified quantity of rum—(the largest rum distillery in the world was a subsidiary of Starlodge) —and furthermore free you from the rigors of the winter harvest, with 26 fully programmed mechanical farm laborers. (The winters here were not even cool by Earth standards, but something about the season made the local animals restless enough occasionally to jump over the walls that normally protected farmland.)

—These mechanical workers would not be good to eat? For the animals?

—No, and they would be very hard for the animals even to damage.

There was a lot of whispered conversation. Uncle conferred with the !tang at the front of each row, then returned.

—I die. Before I die my body turns hair-side-in. People come from everywhere to see the insides of themselves. But the sight makes them lose will, and all die. O the embarrassment. The rum is welcome but we cannot accept the mechanical workers. When the beast eats someone he sleeps, and can be killed, and eaten in turn. If he does not eat he will search, and in searching destroy crops. This we know to be true.

—Then allow me to triple the quantities of gin, bourbon, and brandy. I will add two tonnes each of vermouth and hydrochloric acid, for flavoring. That came to about H710.

—This is gratefully accepted. Does your tribe, Lafitte, care to include these as a subset of your final offer?

—Final offer, Uncle?

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—Two legs, two arms, two eyes, two mouths, two offers.

—I die, Lafitte said. —Where they bury me, the ground caves in. It swallows up the city and all die. O the embarrassment. Look, Uncle, that's the market law for material objects. You can't move land around; its ownership is an abstraction.

Uncle exposed one arm—the Council tittered—and reached down and thumped the floor twice. —The land is solid, therefore material. You can move it around with your machines; I myself saw you do this in my youth, when the spaceport was built. The market law applies.

Lafitte smiled slowly. —Then the Navarro's tribe can no longer bid. He's had two.

Uncle turned to the Council and gestured toward Rabbit, and said, —Is he standing on feet? And they cracked and snuffled at the joke. To Lafitte he said, —The Navarro's offer was rejected, and he made a substitution. Yours was not rejected. Do you care to make his amended offer a subset of yours?

—If mine is rejected, can I amend it?

This brought an even louder reaction. —Poor one, Uncle said. —No feet, no hands. That would be a third offer. You must see that.

—All right. Lafitte began pacing. He said he would start with my amended offer and add the following things. The list was very long. It started with a hydroelectric generator and proceeded with objects of less and less value until he got down to individual bottles of exotic liqueurs. By then I realized he was giving me a message: he was coming down as closely as he could to exactly a thousand shares of Hartford. So we both had the same limit. When he finished he looked right at me and raised his eyebrows.

Victory is sweet. If the Rabbit had bothered to spend a day or two in the marketplace, watching transactions, he wouldn't have tried to defeat me by arithmetic; he wouldn't have tried by accretion to force me into partnership.

Uncle looked at me and bared his arms for a split second. —Your tribe, Navarro? Would you include this offer as a subset of your final offer?

What Rabbit apparently didn't know was that this bargaining by pairs of offers was a formalism: if I did simply add to his last offer, the haggling would start over again, with each of us allowed another pair. And so on and on. I unlocked my briefcase and took out two documents.

—No. I merely wish to add two inducements to my own previous offer (sounds of approval and expectation). Lafitte stared, his expression unreadable.

—These contracts are in Spanish. Can you read them, Uncle?

—No, but there are two of us who can.

—I know how you like to travel. I handed him one of the documents. —This allows each of five hundred !tang a week's vacation on the planet of its choice; any planet where Starlodge has facilities.

"What?" Lafitte said, in English. "How the hell can you do that?"

"Dead-heading," I said.

One of the Council abruptly rose. "Pardon me," he said in a weird parody

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of English, "we have to be dead to take this vacation? That seems of little value."

I was somewhat startled at that, in view of the other inducement I was going to offer. I told him it was an English term that had nothing to do with heads or death. —Most of the Hartford vessels that leave this planet are nearly empty. It is no great material loss to Hartford to take along non-paying guests, so long as they do not displace regular passengers. And Hartford will ultimately benefit from an increase in tourism to !ka'al, so they were quite willing to make this agreement with my tribe.

—The market value of this could be quite high, Uncle said.

—As much as five or six hundred shares, I said, —depending on how distant each trip is.

—Very well. And what is your other inducement?

—I won't say. (I had to grin.) —It is a gift.

The Council chittered and tweeted in approval. Some even exposed their arms momentarily in a semi-obscene gesture of fellowship. "What kind of game are you playing?" Peter Rabbit said.

"They like surprises and riddles." I made a polite sound requesting attention and said —There is one thing I will tell you about this gift: it belongs to all three mercantile classes. It is of no value, of finite value, and infinite value, all at once, and to all people.

—When considered as being of infinite value, Uncle said, —how much is it worth in terms of Hartford stock?

—Exactly one hundred shares.

He rustled pleasantly at that, and went to confer with the others. "You're pretty clever, Dick," Rabbit said. "What, they don't get to find out what the last thing is unless they accept?"

"That's right. It's done all the time; I was rather surprised that you didn't do it."

He shook his head. "I've only negotiated with !tang off-planet. They've always been pretty conventional."

I didn't ask him about all the fishing he had supposedly done here. Uncle came back and stood in front of us.

—There is unanimity. The land will go to the Navarro's tribe. Now what is the secret inducement, please? How can it be every class at once, to all people?

I paused to parse out the description in !tangish. —Uncle, do you know of the Earth corporation, or tribe, Immortality Unlimited?

—No.

Lafitte made a strange noise. I went on. —This Immortality Unlimited provides a useful service to humans who are apprehensive about death. They offer the possibility of revival. A person who avails himself of this service is frozen solid as soon as possible after death. The tribe promises to keep the body frozen until such time as science discovers a way to revive it.

—The service is expensive. You pay the tribe one full share of Hartford stock. They invest it, and take for themselves one tenth of the income, which is their profit. A small amount is used to keep the body frozen. If and when revival is possible, the person is thawed, and cured of whatever was killing him, and he will be comparatively wealthy.

—This has never been done with nonhumans before, but there is nothing forbidding it. Therefore I purchased a hundred "spaces" for !tang; I leave it

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to you to decide which hundred will benefit.

—You see, this is of no material value to any living person, because you must die to take advantage of it. However, it is also of finite worth, since each space costs one share of Hartford. It is also of infinite worth, because it offers life beyond death.

The entire Council applauded, a sound like a horde of locusts descending. Peter Rabbit made the noise for attention, and then he made it again, impolitely loud.

—This is all very interesting, and I do congratulate the Navarro for his cleverness. However, the bidding is not over.

There was a low, nervous whirring. "Better apologize first, Rabbit," I whispered.

He bulled ahead. —Let me introduce a new mercantile class: negative value.

"Rabbit, don't—"

—This is an object or service that one does *not* want to have. I will offer not to give it to you if you accept my terms rather than the Navarro's.

—Many kilometers up the river there is a drum full of a very powerful poison. If I touch the button that opens it, all of the fish in the river, and for a great distance out into the sea, will die. You will have to move or . . .

He trailed off.

One by one, single arms snaked out, each holding a long, sharp knife.

"Poison again, Rabbit? You're getting predictable in your old age."

"Dick," he said hoarsely, "they're completely nonviolent. Aren't they?"

"Except in matters of trade." Uncle was the last one to produce a knife. They moved toward us very slowly. "Unless you do something fast, I think you're about to lose your feet."

"My God! I thought that was just an expression."

"I think you better start apologizing. Tell them it was a joke."

—I die! he shouted, and they stopped advancing. —I, um . . .

"You play a joke on your friends and it backfires," I said in Greek.

Rapidly: —I play a joke on my good friends and it backfires. I, uh . . . "Christ, Dick, help me."

"Just tell the truth and embroider it a little. They know about negative value, but it's an obscenity."

—I was employed by . . . a tribe that did not understand mercantilism. They asked me, of all things, to introduce terms of negative value into a trivial transaction. My friends know I must be joking and they laugh. They laugh so much they forget to eat. All die. O the embarrassment.

Uncle made a complicated pass with his knife and it disappeared into his haybale fur. All the other knives remained in evidence, and the !tang moved into a circle around us.

—This machine in your pocket, Uncle said, —it is part of the joke?

Lafitte pulled out a small gray box. —It is. Do you want it?

—Put it on the floor. The fun would be complete if you stayed here while the Navarro took one of your marvelous floaters up the river. How far would he have to go to find the rest of the joke?

—About twelve kilometers. On an island in midstream.

Uncle turned to me and exposed his arms briefly. —Would you help us with our fun?

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The air outside was sweet and pure. I decided to wait a few hours, for light.

That was some years ago, but I still remember vividly going into the Council Building the next day. Uncle had divined that Peter Rabbit was getting hungry, and they'd filled him up with !tang bread. When I came in, he was amusing them with impersonations of various Earth vegetables. The effect on his metabolism was not permanent, but when he left Alberio III he was still having mild attacks of cabbageness.

By the time I retired from Hartford, Starlodge had finished its hotel and sports facility on the beach. I was the natural choice to manage it, of course, and though I was wealthy enough not to need employment, I took the job with enthusiasm.

I even tried to hire Lafitte as an assistant—people who can handle !tangish are rare—but he had dropped out of sight. Instead, I found a young husband-and-wife team who have so much energy that I hardly have to work at all.

I'm not crazy enough to go out in the woods, hunting. But I do spend a bit of time fishing off the dock, usually with Uncle, who has also retired. Together we're doing a book that I think will help our two cultures understand on another. The human version is called *Hard Bargain*.■

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Probability Zero

LOOPHOLE

Timothy Zahn

"But I don't *want* to be cloned!" Dallas Jones wailed for the sixth time, bringing his lunchbox-sized fists down hard on the desk in front of him.

Seated behind the desk, Attorney First Class Herm Trice sent up a silent prayer for his furniture and surreptitiously slid his chair back an inch or two. "I'm sorry, Mr. Jones," he said in a voice usually reserved for hostile juries. "The contract you signed three years ago gives the Pittsburgh Steelers *all* rights to the use of your body, and that includes the right to clone you if they so desire. Now, if you want to challenge that in court, I'm willing to go along; but I can tell you right now we'll lose."

"Well, can't I buy back the contract or something? Give 'em back all the money they've paid me?"

Herm sighed. He'd thought Iowa had run out of naïve farm boys long ago. "Not a chance. Look, you should be feeling honored: you're only the fourth player the Steelers have ever cloned, and the first running back. Think of it as having a whole brood of kids, free of charge, to pass your name down to posterity."

That was the wrong thing to say. "I don't *want* any broody kids," Dallas snapped, assaulting the desk again. "And I don't want *any* kid except I get him in the usual way. It ain't natural."

"Well, like it or not, I'm afraid you're stuck with it," Herm shrugged. "McGonald's, which owns the Steelers, holds the patents on the cloning process they'll be using, so we can't even appeal to any third company—and as I said before, they pretty well own *you*, too."

"They own the process, too?" Dallas blinked.

"Sure do. How else do you think they can advertise 'quality and taste you can *always* count on'? All their burgers are ultimately from the same animal."

Herm caught his breath suddenly; given that Dallas was already built like a side of beef, that last comment was particularly ill-advised.

But Dallas didn't explode. He just sat there, something that might have been an idea flickering just behind his eyeballs. "Okay, Mr. Trice," he said, levering his bulk out of Herm's guest chair, which creaked gratefully. "Thanks for your help."

Herm never saw Dallas Jones in person again; indeed, once the boy had paid his bill, the lawyer forgot him completely. Until, that is, a year or so later when an item in *Judicial Review* caught his eye, announcing that Dallas had won his suit against the Steelers. Reading further, he found the argument used: on the basis of the *Diamond vs. Chakrabarty* Supreme Court decision of 1980 regarding new forms of life, Dallas had had his parents *patent* him, and the court had ruled that they had the prior claim.

Herm shook his head admiringly. Maybe, just maybe, Iowa farm boys weren't as naïve as he had thought. ■

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The space advocates and the environmentalists may be converging toward a common goal at last because the two groups have just discovered that they have a common goal.

They are separated by a lack of communication, a barrier that has started to crumble because both groups are at last beginning to get their acts together and to develop the rationales and justifications necessary to proceed further.

The initial contacts between the two groups produced the anticipated reactions one would expect on first contact—goal defense, ego-massaging, method justification, expounding of the problems, etc.

But the two groups, perceived by outsiders and even by some group members themselves as being mutually antagonistic to one another's goals, *do* have a common, over-arching, and extremely important goal:

Both the space advocates and the environmentalists want to save the Earth.

The environmentalists have recognized the problems. The Earth is finite. Its natural resources are finite and limited (but not as limited as many people believe). The extractive and fabricative industrial operations are basically incompatible with the Earth's biosphere because, on a temporary and localized scale, these operations disrupt the biosphere. Many of the energy resource and production options are not compatible with the biosphere; coal and petroleum usage causes localized ecological damage during extraction, requires transportation to its use location, and produces combustion products that are unnatural with respect to quantity and composition.

The environmentalists have problems requiring viable solutions, but they have not yet developed viable solutions. They have advocated low-tech, decentralization, and a general reduction in industrial activity in the extractive and fabricative activities. But a viable solution does *not* involve cutting back, extreme conservation, regression to a pastoral existence, etc. Such a solution would permit only about 10 percent of the Earth's population to survive. Question: Who decides who survives? Most probable answer based on history: Men on horseback leading armies. This puts the environmentalists in a quandary. Some of them will openly admit it. Others become abusively defensive when queried about the logical consequences of some of their proposed solutions.

The space advocates have recognized that they've got a lot of solutions to the world's problems by using high technology and private enterprise. People can live quite well and comfortably in space. The Apollo manned lunar land-

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ings and the Voyager, Viking, and Mariner unmanned missions to other planets have revealed that the raw materials and energy resources of the Solar System so greatly surpass those of Earth that, for all intents and purposes, extraterrestrial resources can offer an effective solution to the terrestrial extractive problem. There is also energy available in space: the energy of a star—star power. And the environment of space is unique and *benign* to industrial operations, offering the option of continuing to expand and develop the industrial infrastructure needed by the people of the world but without the slightest possibility of impacting the terrestrial biosphere.

But the space advocates have had trouble getting other people to identify the problems for which they have the solutions. High technology is neat, and one can do lots of neat tricks with it. It is also perceived as being expensive, which is a relative term totally dependent upon the importance of the problem to be solved. High technology can be used to solve many problems. In fact, one of the major difficulties of high technology is exemplified by the laser which was once labelled as a "solution looking for a problem" when it was invented. But did the laser ever find problems to solve! And most of the lasers in the world are used in peaceful, harmless industrial and medical applications that one rarely hears about because these applications are now so commonplace and ubiquitous.

Both groups are right.

Both groups have something the other needs.

The environmentalists have identified the problems and have been successful in communicating them to the public. But they lack the *viable* solutions to the problems they've identified.

The space advocates have discovered the solutions to the problems but are lacking the believable rationales and justifications developed and espoused by the environmentalists.

It's time for the two groups to form an alliance.

To some extent, this has already happened.

But it isn't an easy process to form this alliance, primarily because both groups speak a slightly different language and have had to face entirely different barriers to acceptance. And both groups are rather fond of preaching, especially to the choir. To some extent, both groups see the other as an adversary when, right down at the roots, they are not because they both share the same long-range goal.

Eric Hoffer, the longshoreman philosopher, pointed out in his book, "The True Believer," that any successful mass movement must have three elements:

1. A plausible goal.
2. An infallible leader.
3. A devil.

Looking at both the environmentalists and the space advocates, one can ascertain that the two groups have all three elements, although some of the elements are on somewhat shaky ground.

Both groups have the same plausible goal: To save the Earth, to recreate the Garden of Eden, and to restore the planet to the condition it was in about 10,000 years ago when our remote ancestors were completing their final evolution as human beings. Nobody will

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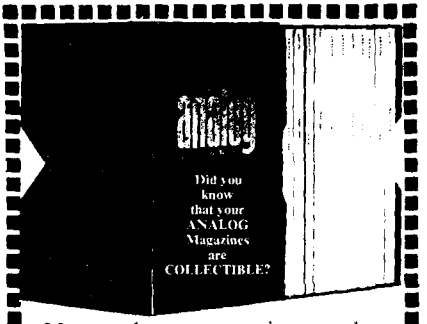
deny that human beings need green grass and animals around them, that they need elbow room, that they need to be able to sequester themselves privately with small groups of intimates for social purposes, and that they need to have work that challenges them and often has a bit of danger involved. "Primitive" peoples who live in tune with their environment possess these; they are hunters, and they are among the gentlest, most polite peoples on Earth (but don't go back on your word to them because they are also mean, nasty, and vicious as hunters must be).

Both groups have a plethora of infallible leaders, which is a major hurdle that must be overcome for them to get together and join forces. These leaders have very powerful egos; they *must* have powerful egos to be the sort of leaders these groups required. Getting them together will be the most difficult task in uniting the efforts of the two groups. It may require the intervention of a third party who possesses stronger leadership abilities and charisma than any of the existing leaders.

Both groups also have their own devil. Unfortunately, the devil is perceived to be the other group! This isn't so, of course, because both groups share the same goal. But it is *perceived* as such. In the meantime, the real devil goes unrecognized and therefore free to wreak havoc in both groups while placing the blame for same on the other.

There are many devils common to both groups. They aren't devils; they are people. They are the people who have a vested interest in the *status quo;* who have it knocked right now and want to remain in the catbird seat or driver's



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seat as the case may be; who are interested in only short-term goals because they cannot see that the consequences of these short-term goals will affect them; and, most importantly, the people who simply *don't care*.

It will be to the mutual benefit of both groups for the environmentalists and the space advocates to get together, strike a bargain, and co-ordinate efforts, because they do have a common long-range goal that both believe is of *vital* importance . . . and it is.

It is also inevitable that the two get together because they cannot afford to waste time and effort in a futile battle against one another once they recognize their commonality and discover that together they can be highly effective against the *real* devil.

Anthropologist Carleton S. Coon observes that all living organisms follow the biological Law of Least Effort. Because the unification of the efforts of the environmentalists and the space advocates represents a line of least effort, this unification will take place sooner or later.

The sooner it takes place, the better, because time is of the essence right now.

The environmentalists can identify and sell the problem; the space advocates can provide the solutions.

And everybody wins!

And that's the greatest consequence, the biggest benefit, and a most compelling argument for both environmentalists and space advocates.

And for the world, too.

This is *not* one of those stances that I take just to be controversial and to get people thinking as I pointed out in an earlier column entitled, "Some Notes About Change."

And I'll bet it surprises those readers who believed I was a strong adversary of the environmentalists. I *am* an adversary of anyone who believes or acts irrationally, and I have written some strong words that made some environmentalists angry. But now that common ground has been found between the environmentalists and the space advocates, and as a bond of commonality is forged between the two groups, it would be irrational on my part to stand between them.

Together, we can turn this into a win-win game to everyone's benefit. ■

● Unless you believe in a totally fixed and immutable timestream (in which case it doesn't matter what you do, everything's frozen in cement already), then the future must be a series of events that have not yet happened, and therefore can be altered, changed, diverted, moved, shaped by myriads of individual decisions. There is no one certain future; there are countless possible futures, with every moment bringing new opportunities to hand.

Ben Bova

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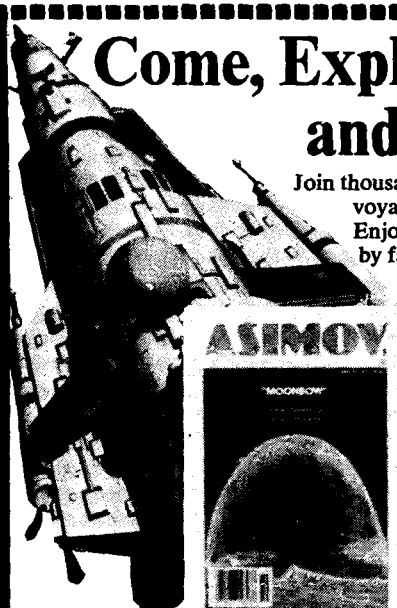

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1.

You remember silence, don't you?

There were many silences once: silence for a great speech, silence before an outburst of thunderous applause, silence after laughter. Silence is gone forever, now. When you listen to the places where the silence used to be, you hear the soft insidious buzzing, like a swarm of distant flies, that proclaims the end of man's solitude. . . .

For me, it happened like this: It was opening night, and Hamlet was just dying, and I was watching from the wings, being already dead, of course, as Guildenstern. I wanted to stay for curtain call anyway, even though I knew the audience wouldn't notice. It hadn't been too long since my first job, and I was new in New York. But here everything revolved around Sir Francis FitzHenry, brought over from England at ridiculous expense with his new title clinging to him like wrapping paper.

Everything else was as low-budget as possible, including me. They did a stark, empty staging, ostensibly as a sop to modernism, but really because the backers were penniless after paying FitzHenry's advance, and so Sir Francis was laid out on a barren proscenium with nothing but an old leather armchair for Claudius's throne and a garish green spot on him. Not that there was any of that Joseph Papp-type avant-garde rubbish. Everything was straight. Me, I didn't know what people saw in Sir Francis FitzHenry till I saw him live—I'd only seen him in that ridiculous Fellini remake of *Ben Hur*—but he was dynamite, just the right thing for the old Jewish ladies.

There he was, then, making his final scene so heartrending I could have drowned in an ocean of molasses; arranging himself into elaborate poses that could have been plucked from the Acropolis; and uttering each iambic pentameter as though he were the New York Philharmonic and the Mormon Tabernacle Choir all rolled into one. And they were lapping it up, what with the swing away from the really modern interpretations. He was a triumph of the old school, there on that stage turning the other actors into ornamental papier-mache all around him.

He had just gotten, you know, to that line:

Absent thee from felicity awhile . . .
To tell my story.

and was just about to fall, with consummate grace, into Horatio's arms. You could feel the collective catch of breath, the palpable silence, and I was thinking, *What could ever top that, my God?* . . . and I had that good feeling you get when you know you're going to be drawing your paycheck for at least another year or so. And maybe Gail would come back, even.

Then—

Buzz, buzz, buzz, buzz. "What's wrong?" I turned to the little stage manager, who was wildly pushing buttons. The buzzing came, louder and louder. You couldn't hear a word Horatio was saying. The buzzing kept coming, from every direction now, hurting my ears. Sir Francis sat up in mid-tumble and glared balefully at the wings, then the first scream could be heard above the racket, and I finally had the nerve to poke my head out and saw the tumult in the audience. . . .

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"For Chrissakes, why doesn't someone turn on the house lights?" Claudius had risen from where he was sprawled dead and was stomping around the stage. The buzzing became more and more intense, and now there were scattered shrieks of terror and the thunder of an incipient stampede mixed into the buzzing, and I cursed loudly about the one dim spotlight. The screaming came continuously. People were trooping all over the stage and were tripping on swords and shields, a lady-in-waiting hurtled into me and squished makeup onto my cloak, corpses were groping around in the dark, and finally I found the right switch where the stage manager had run away and all the lights came on and the leather armchair went whizzing into the flies.

I caught one word amid all this commotion—

Aliens.

A few minutes later everybody knew everything. Messages were being piped into our minds somehow. At first they just said *don't panic, don't panic* and were hypnotically soothing, but then it all became more bewildering as the enormity of it all sank in. I noticed that the audience were sitting down again, and the buzzing had died down to an insistent whisper. Everything was returning to a surface normal, but stiff, somehow; artificial. They were all sitting, a row of glassy-eyed mannequins in expensive clothes, under the glare of the house lights, and we knew we were all hearing the same thing in our minds.

They were bringing us the gift of immortality, they said. They were some kind of galactic federation. No, we wouldn't really be able to understand what they were, but they would not harm us. In return for their gift, they were exacting one small favor from us. They would try to explain it in our terms. Apparently something like a sort of hyperspatial junior high school was doing a project on uncivilized planets, something like "one day in the life of a barbarian world." The solar system was now in some kind of time loop, and would we be kind enough to repeat the same day over and over again for a while, with two hours off from 6 to 8 every morning, while their kids came over and studied everything in detail. We were very lucky, they added; it was an excellent deal. No, there wasn't anything we could do about it.

I wondered to myself, how long is "over and over again for a while"?

They answered it for me. "Oh, nothing much. About seven million of your years." I felt rather short-changed, though I realized that it was nothing in comparison with immortality.

And, standing there stock-still and not knowing what to think, I saw the most amazing sight. We all saw the aliens as gossamer veils of light that drifted and danced across the field of vision, almost imperceptible, miniature auroras that sparkled and vanished. . . . I saw Sir Francis's face through a gauze of shimmering blue lights. I wanted to touch them so badly; I reached out and my hand passed right through one without feeling a thing. Then they were gone.

We turned off the house lights—we had until midnight—and went on with the play. The buzzing subsided almost completely, but was very obviously there all the time, so everybody gabbled

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their lines and tried to cut in quickly between speeches to cover up the noise. The applause was perfunctory, and Sir Francis seemed considerably distressed that he had been so easily upstaged.

I walked home at a few minutes to midnight. I saw peculiar poles with colored metallic knobs on them, all along Broadway every couple of blocks, like giant parking meters. The streets were virtually empty, and there were a couple of overturned Yellow cabs and an old Chevy sticking out of a store window. It had been too much for some, I supposed. But I was so confused about what had happened, I tried to think about nothing but Gail and about the bad thing that had happened that morning.

I climbed up the dirty staircase to my efficiency above an Indian grocery store and jumped into bed with all my clothes on, thinking about the bad thing between me and Gail, and at midnight I suddenly noticed I was in pyjamas and she was lying there beside me, and there was a sudden jerk of dislocation and I knew that it wasn't *today* anymore, it was *yesterday*, it was all true. I squeezed my eyes tightly and wished I was dead.

2.

I woke up around 11 o'clock. Gail stirred uneasily. We made love, like machines. I kept trying to pull myself away, knowing what was coming. Whatever the aliens had done, it had turned me into a needle in a groove, following the line of least resistance.

We got up and had breakfast. She wore her ominous dishevelled look, strands of black hair fishnetting her startlingly blue eyes.

"John?"

The dinette table seemed as wide as all space. She seemed incredibly unreachable, like the stars. "Umm?" I found myself saying in a banal voice. I knew what she was going to say; I knew what I was going to do. But whatever it was dealt only with appearances. In my thoughts I was free, as though I were somehow outside the whole thing, experiencing my own past as a recording. I wondered at my own detachment.

"John, I'm leaving you."

Anger rose in me. I got up, knocking over the coffee mug and shouting, "What for, who with?" like an idiot before going off into incoherent cursing.

"Francis FitzHenry has asked me to stay with him—in his suite at the Plaza!"

The anger welled up again. Blindly, I slapped her face. She went white, then red, and then she said quietly, dangerously: "You're too petty, John. That's why you're going to be a Guildenstern for the rest of your life." That hurt.

Then she walked out of my life.

I shaved and walked slowly over to the theater. We played to a full house. The aliens came. Sir Francis seemed considerably distressed that he had been so easily upstaged. I walked home, casually noting the two overturned Yellow cabs and the old Chevy stuck in a store window, past the overgrown parking meters, to my efficiency above an Indian grocery store, and threw myself fully clothed on the bed. I fell asleep.

I woke up around 11 o'clock. Gail stirred uneasily. We made love mechanically, and I knew that the two peo-

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ple who were lying there together had become totally divorced from themselves, and were going through preordained motions that bore no relationship whatsoever to what was in their minds. And there was no way of communicating.

We ate breakfast. She wore her ominous dishevelled look, and I desperately wanted to apologize to her, but when I tried to speak my facial muscles were frozen and the buzzing seemed to get louder, drowning my thoughts. Was the buzzing an external sound, or was it some mental monitor to enforce the status quo?

"I'm leaving you."

Anger rose in me. I quenched it at once, but it made no difference either to my posture or to my words.

"Francis FitzHenry has asked me to stay with him—in his suite at the Plaza!"

I slapped her face. Suddenly the veils of light came, caressing the musty stale air of my apartment, touching the dust and making it sparkle, like a golden snow between the two of us. They faded. We had been watched; we were trapped in a galactic Peyton Place.

"You're too petty, John. That's why you're going to be a Guildenstern for the rest of your life." And walked out of my life. It hurt me more every time. I was doomed to be a Guildenstern in this play too, a Guildenstern for the old ladies and a Guildenstern for the veils of light. It was hell.

I shaved and walked slowly over to the theater. We played to a full house. The aliens came; Sir Francis seemed considerably distressed that he had been so easily upstaged. I walked home, past the overturned cars and the gigantic parking meters that had materialized out of nowhere.

As I fell asleep, just before midnight, a thought surfaced: we were supposed to have two free hours every morning, weren't we? For months now, I had slept through those two hours.

I resolved to force myself to wake up at six.

3.

I jerked myself awake at 6:30, snaked into unostentatious jeans and a T-shirt, and came down.

The brilliant summer morning hit me between the eyes. It had been autumn the previous night. Everything was to wonder at: the trash drifting down the sidewalk in the breeze, the briskness of the air, the clarity of the sunlight . . .

Two tramps were leaning against the first of the alien poles. They had their eyes closed and were very peaceful, so I crept away. Potholes exuded smoke, people jostled each other, and everything seemed astonishingly normal, except for the insistent buzzing.

Another of the poles had a man in a scruffy three-piece suit and blatantly orange tie, holding up a sign on which was scrawled VON DANIKEN LIVES! He had acquired a squalid-looking collection of onlookers, whom I joined for a moment.

". . . man, these critters built the *Pyramids!* They built the *Empire State Building!* They're the Gods! Alexander the Great was one! Richard M. Nixon was one! God was one! . . . and you, too, can be saved, if only you'll just

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throw a quarter on the altar of repentance! Hallelujah! Thank you, ma'am. . . ."

I walked on.

At the next extraterrestrial parking meter a group of Hare Krishna types was dancing round and round like they had a missionary in the pot. In the middle a scrawny, bespectacled shaven man was caressing the shaft, which was glowing a dull crimson. He seemed transfigured, almost beautiful, much more like the real thing than Sir Francis FitzHenry could ever be. I watched for a long time, fascinated, my mind dulled by the hypnotic repetitiveness of their chanting.

They ceased, jolting me from my reverie. The lanky one came up to me and started to whisper confidentially, intensely, "Did you know they're only a few microns thick? Did you know that they're called the *T'tat?* Did you know they have a shared consciousness that works over vast reaches of space-time? Did you know they've reached an incredibly high evolutionary phase, huh?"

"You don't talk like a Hare Krishna person."

"Hey! . . . oh, the clothes, you mean. Actually, I have a Ph.D. from M.I.T. I *talk* to them, you know."

"No kidding?"

"Hey, really! Listen, come here," he pulled me roughly over to the pole, which had stopped glowing. "Just sit down here, relax now, touch the pole. Totem pole, divine antenna, whatever. Can't you hear anything. . . ?"

Hello.

I was shivering. The voice was so close; it was speaking inside me. I drew back quickly.

"Hey, did you know they have many colors, that each color shows their status based on age? Did you know that, huh? Did you know they don't join up with the collective consciousness until they're almost half a billion years old, that they have these learning centers all over the galaxy, that they originally crossed over from the Great Nebula in Andromeda? No kidding, man!"

I didn't know what he was talking about.

"Here, touch it again, it isn't so bad the second time." He was twitching all over, a bundle of nerves. "Sorry I'm acting like this. It's my only chance to act normal, you see, the rest of the day I'm either stoned or asleep, according to the script. I can't wait till we all wake up!"

I reached out. *Hello.*

"Isn't there any way we can *resist* them?"

"What for? Don't you want to live forever? This is just a sort of Purgatory, isn't it? We all get to go to heaven."

"But suppose I wanted to, you know, contradict them, or something."

"Dunno. They can't control *everything*." He paused for a moment, but then launched himself into a stream of information again, as though I'd fed him another quarter.

"I have the general equations worked out." He flashed a bit of paper in front of my face, then thrust it back into his pocket—"but you obviously have to be in control of unified field theory, and even then there's the power source to worry about. I have a couple of theories—f'rinstance, if they had sort of a portable mini-quasar, like, a miniature white hole worming through space-time

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into a transdimensional universe, they could tap the energy, you see, and—"

He had lost me. I touched the pole, and his voice faded into nothingness. The buzzing intensified. *Hello.*

"We're just dirt to you, laboratory animals," I said bitterly. "I wish it was back to the way it was."

You can't help being a lower being, you know. There's nothing you or I can do about that.

"Well, will you tell me one thing?" It suddenly occurred to me that everyone had left. The Hare Krishnas, hands linked, had gone dancing off.

Sure.

"Is this thing really worth it, for us? Seven million years is a long, long, time; it's the same as eternity for all practical purposes."

Hah! Fat lot you know.

"You didn't answer my question."

All in good time. But it's almost 8 o'clock. Hold on, you'll be dislocated back to yesterday in a few seconds. You're pretty lucky, you know; in some parts of the world the two hours' grace comes at some ridiculous time and nobody ever *gets up.*

"Goodbye."

Goodbye.

I woke up around 11 o'clock. Gail stirred uneasily. We made love mechanically, like machines, with living sheets of light, only a few microns thick, darting between us, weaving delicately transient patterns in the air, and I felt hollow, transparent, empty.

4.

I met Amy Schechter in Grand Central Station, coming out of the autumn night into a biting blizzard of a winter morning.

We were both standing at a doughnut stand. I looked at her, helpless, frail, as she stared into a cup of cold coffee. I had seen her before, but this morning there were just the two of us. She suddenly looked up at me. Her eyes were brown and lost.

"Hi. Amy."

"John."

A pause, full of noisome buzzing, fell between us.

For a while, I watched the breath-haze form and dissipate about her face, wanting to make conversation, but I couldn't think what to say.

"Will you talk to me? Nobody ever does, they always back off, as if they knew."

"Okay."

"I've been standing here for five years, waiting for my train. Sometimes I come an hour or so before 8 o'clock, you know, just to stand around. There's nothing for me at where I'm staying." Her voice was really small, hard to hear against the buzzing.

"Where are you going?"

"Oh, Havertown, Pennsylvania. You've never heard of it." I hadn't. "It's sort of a suburb of Philadelphia," she added helpfully. "My folks live there."

"Buy you a doughnut?"

"You must be joking!" She laughed quickly and stopped herself, then cast her eyes down as though scrutinizing a hypothetical insect in her styrofoam cup. Then she turned her back on me, hugging her shaggy old coat to her thin body, and crumpled the cup firmly and threw it into the garbage.

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"Wait, come back! We've got an hour and a half, you know, before you have to leave—"

"Oh, so it's score and run? Nothing doing, friend."

"Well, I *will* buy you a doughnut then."

"Oh, all right. A romantic memory," she added cynically, "when I'll be dead by dinner anyway."

"*Huh?*"

She came closer. We were almost touching, both leaning against the grubby counter. "I'm one of the ghosts, you know," she said.

"I don't get it."

"What do *you* do every day?"

"My girlfriend walks out on me, then I play a poor third fiddle to a pretentious British actor in *Hamlet*."

"Lucky. In *my* script, the train crashes into an eighteen-wheeler 25 miles outside of Philadelphia. Smash! Everybody dead. And then every morning I find myself at the station again. I was pretty muddled at first, the aliens never made any announcements to *me* while I was lying in the wreckage. So I do it all over and over again. One day I may even enjoy it."

It didn't sink in. "Chocolate covered?" I asked inanely.

"Yeah."

There was another pause. I realized how much I needed another person, not Gail, how much I needed someone real. . . .

"We should get to know each other, maybe," I ventured. "After it's all over, maybe we could—"

"No, John. Nothing doing. I'm a ghost. I'm not immortal, don't you see! The whole deal ignores me completely! I'm dead already, dead, permanently dead! You don't get to be part of the deal if you die sometime during the day, you have to survive through till midnight, don't you see?"

". . . oh God." I saw.

"They've just left me in the show to make everything as accurate as can be. I'm an echo. I'm nothing."

I didn't say a word. I just grabbed her and kissed her, right there in the middle of the doughnut stand. She was quite cold, like marble, like stone.

"Come on," she said. We found a short-time hotel around the block; I paid the eight dollars and we clung together urgently, desperately, for a terribly brief time.

I woke up at around 11 o'clock. Gail stirred uneasily. As I went through the motions for the thousandth time I was thinking all th time, *this isn't fair, this isn't fair.* Gail was alive, she was going to live forever, and she's just like a machine, she might just as well be dead. Amy, now, she was dead, but so *alive!* Then I realized a terrible truth: *Immortality kills!* I was very bitter and very angry, I felt cheated, and the buzzing sounded louder, like a warning, and I knew then that I was going to try and do something dreadful. ("They can't control *everything*," wasn't that what the Krishna freak had said?)

I struggled, trying to push myself out of the groove, trying to change a little bit of one little movement, but always falling back to the immutable past. . . .

We got up and had breakfast. She wore her ominous dishevelled look, strands of black hair fishnetting her startlingly blue eyes.

"John?"

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"Umm?"

"John, I'm leaving you."

"What for, who with?"

"Francis FitzHenry has asked me to stay with him—in his suite at the Plaza!"

I lifted my hand, then willed with every ounce of strength I could dredge up from every hidden source.

I didn't slap her face.

A look of utter bewilderment crossed her face, just for one split second, and I looked at her and she looked at me, her emotions unfathomable; and then the whole thing swung grotesquely back to the original track, and she said quietly, dangerously, "You're too petty, John. That's why you're going to be a Guildenstern for the rest of your life." As though nothing were different. That hurt.

Then she walked out of my life.

But I had changed something! And we had communicated; for a split second something had passed between us!

The buzzing became a roar. I walked slowly to the theater, bathed in the glow of a hundred diaphanous wisps of light.

5.

It was a couple of minutes before 8 when the phone rang in my apartment. I decided to make a run for it, so I made for the kitchenette in the nude.

"Yeah?"

"This is Michael, John." Michael played Horatio. He was sobbing, all broken up. I didn't know him very well, so I played it cool. "John, I'm going to do something terrible! I can't stand it, you're the first person I could get through to this morning, I'm going to try and—"

I woke up around 11 o'clock. Gail stirred uneasily. We had breakfast, and I didn't slap her face.

It seemed too natural. I realized that I had changed the pattern. This is the way it would always be from now on.

I had never slapped her face.

A look of utter bewilderment . . . but it was no longer a communication, it was just a reflex, part of the pattern, and then she said quietly, dangerously, "You're too petty, John. That's why you're going to be a Guildenstern for the rest of your life."

That hurt. Then she walked out of my life.

I went to the theater. There was Sir Francis, making his final scene so heart-rending I could have drowned in a sea of molasses; arranging himself into elaborate poses that could have been plucked from the Acropolis; and uttering each iambic pentameter as though he were the New York Philharmonic and the Mormon Tabernacle Choir all rolled into one. He was dying, and he clutched at Horatio, and he said, measuring each phrase for the right mixture of honey and gall—

Absent thee from felicity awhile . . .
To tell my story.

and was just about to fall, with consummate grace, into Horatio's arms, and you could feel the collective catch of breath, the palpable silence except for the quiet buzzing, when Horatio drew a revolver from his doublet and emptied it into Sir Francis's stomach.

After the aliens departed from the theater, the play went on, since Hamlet was dead anyway, and afterwards I

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walked home. I saw peculiar poles with metallic knobs on them, all along Broadway every couple of blocks, and there were a couple of overturned Yellow cabs, but the old Chevy was gone from the store window. Good for them.

In the morning I met Amy. I told her about what had happened.

"When you get to just before your accident, try to jump out of the car or something. Keep trying, Amy, just keep trying."

She chewed her doughnut, deliberating. "I don't know."

"Well, we've got another six million, nine hundred thousand, nine hundred and ninety-four years to try in. So keep at it, okay?"

She seemed unconvinced.

"Just for me, try."

I kissed her quickly on the forehead and she disappeared into the crowd that was heading towards the platform.

6.

The pole was glowing a pale crimson when I touched it.

Hello.

I couldn't contain my rage. "You bastards! Well, we're not powerless after all, we've got free will, we *can* change things. We can ruin your high school project completely, rats that we are!"

Oh. Well, that too is one of the things under study at the moment.

"Well, let me tell you something. I don't want your immortality! Because I'd have to give up being a person. Being a person means changing all the time, not being indifferent, and you're changing us into machines."

Oh? And do you deny that you've changed?

It was true. I had changed. I wasn't going to be a Guildenstern for the rest of my life anymore. I was going to fight them; I was going to learn everything I could about them so I could try and twist it against them; I was going to be a real human being.

There are things you can't do anything about. You're in a transitional stage, you see. With immortality will come a change in perspectives. You won't feel the same anymore about your barbarian ways, Earthling.

I had to laugh. "Where did you learn to talk like that?"

We monitored your science fiction TV broadcasts.

The picture of these alien schoolkids, clustering around a television set in some galactic suburbia somewhere in the sky. . . . I laughed and laughed and laughed.

But then, seriously: "I'm still going to fight you, you know. For the sake of being human." I had a new fuel to use, after all, against them. Love. Revenge. Heroism. I was thinking of Amy. The good old-fashioned stuff of drama.

Go ahead.

I woke up around 11 o'clock. ■

● It is impossible to travel faster than light, and certainly not desirable, as one's hat keeps blowing off.

Woody Allen

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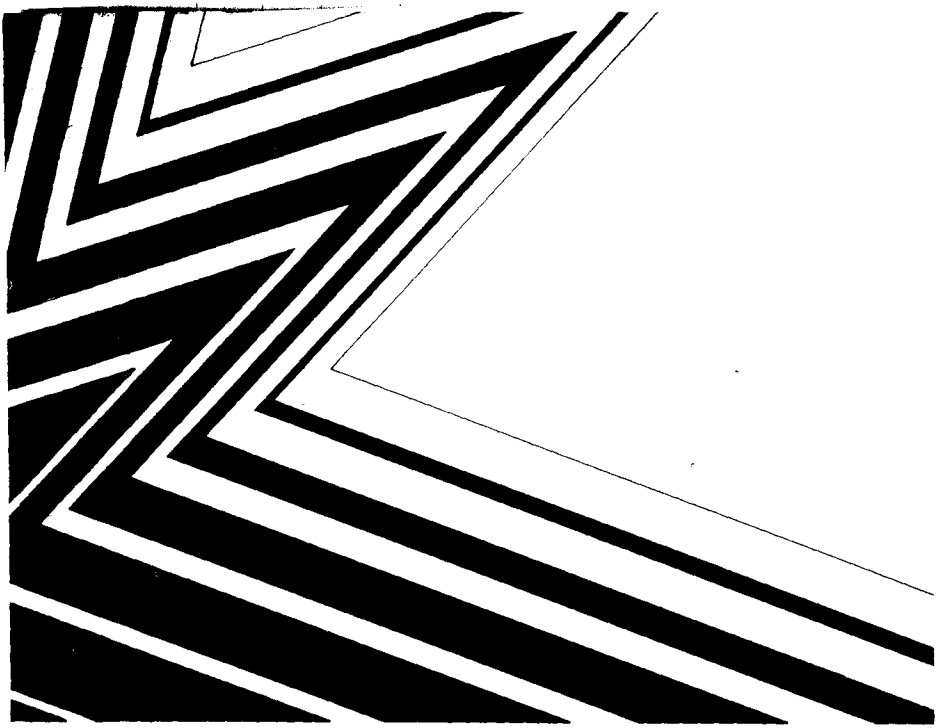

James Odbert

Joe Patrouch

TIGER BY THE TAIL

Everyone knows some things are impossible. So the guy who finds that one of them isn't is likely to be a bit less than prepared to deal with it.

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From Generally Unclear [*the unofficial house organ of General Nuclear, Inc.*]:

July 12, 1985—Well, the guys over in the lab have done it again. Remember that little explosion and fire last week? The one that gutted Area 7 and sent Ed Snide to the hospital? (Where he's doing great, by the way. The burns were worse than the broken bones, he told us.)

Anyway, we now understand that what caused the explosion and fire in the first place was a slight miscalculation in the amount of energy that would be released when the labbies . . . well, when they did *something* new. As usual, it's generally unclear *what*. They expected X amount of energy, and they got X^2 and change. The equipment they had set up wasn't prepared for the surge, and *blooey!* Overload, heat, shorts, sparks, flame. The whole pyrotechnical panel bit.

But note this: What failed was the equipment, not the experiment. Anyone who knows anything at all about it is terribly excited. It was a short proof-of-principle experiment, and it worked. The theory was incorrect only in its prediction of how much energy would be released. X^2, mind you, not merely X. Think about it.

* * *

Mr. Robert Gillespie, GN's director of R&D in St. Louis, snorted impolitely as he tossed the little four-page newsletter back down on his uncluttered desk.

"What we really need to develop around here," he said, "is better security. How can we work out details and get patent applications on file when our own employees insist on telling the competition what we're doing?"

He snatched the offending piece of paper back up and held it in front of his face.

The thin man across the desk from him fidgeted in his uncomfortable plastic chair. "Sir. If you'll excuse me. . . ."

Gillespie lowered the paper and tried to focus his attention on his visitor. "Oh, yes. Horner, isn't it?" He consulted a note in front of him. "Dr. John Horner. New man."

The thin man sat up straighter in his chair, then twisted to his right.

"Uh, yes, sir," he replied. "I've been with the company about a year now. But . . ."

"Well, what's so important you couldn't take it up with Smith or Tchikow?" Gillespie looked at his watch with an overdone theatrical gesture. "They're running that experiment again any minute now, and I have to keep in touch."

Horner jumped up from his chair. "I didn't know that. Security got so tight after *Generally Unclear* broke the story. I'm on the theoretical side of that project, so they didn't even tell me. Oh my God."

He leaned over the desk in what Gillespie took to be a threatening gesture, grabbed the phone from its cradle, and brandished it before Gillespie's eyes.

"Call them," he ordered. "Call them right now and stop them before it's too late."

Gillespie didn't move. He was trying to figure out how to get Security in here to take this madman away.

The impasse lasted maybe ten seconds. Then Horner scurried around the

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desk, the stretched cord sweeping two pens, an eraser, and a family portrait along with it.

"Sorry," he muttered without sorrow, and began punching buttons. As he waited, he shifted his weight from one foot to the other. "Hazel? John Horner. Quick. Tell Harry and Phil not to . . . what? When?" He closed his eyes and listened, mouthing a muted litany of *omigods*.

Then he nodded quickly, twice, like a rooster pecking at grains of corn. "All right, then, tell them this: don't turn it off! Whatever they do, don't let them turn it off." He had to try twice before he could get the receiver back in its cradle.

With wide unblinking eyes he stared down at Gillespie, who was in effect cowering behind his desk, trying to decide whether to make a break for it.

Finally Horner went back to his chair, swallowed, and began making speech sounds again.

"All right," he said, more to himself than to Gillespie. "All right. But maybe it's not too late. Maybe someone will be able to think of something."

He reached into his tattered brown briefcase, pulled out a worn manila folder stuffed with papers, and dropped the mass carelessly onto Gillespie's desk.

"It's all there," he said. "The mathematical proof. In detail. But basically— There's no time for detail now. If only I'd known they were running it again today. Damn. —Basically it's this: *Generally Unclear* had it wrong. The explosion and fire wasn't caused by a power-surge overload when the process was initiated."

Gillespie frowned his disbelief. Of course it had been an overload. Was Horner insane? He started to get up.

"Mr. Gillespie, please hear me out. The trouble came when the power was turned *off*, not on. The energy field didn't merely dwindle down to nothing, like the light in a bulb when you turn off the switch."

"No?" Gillespie didn't really care. He was biding his time 'til help came. Surely someone would walk in. Or call. He studied the phone hopefully.

"No. It doesn't collapse. It expands. It expands to the square of what we expected. And it does so explosively."

Gillespie thought he saw an error in Horner's story. "Wait a minute. When you turn it off, you're not putting anything in any more. You can't get something from nothing. Nothing squared is still nothing." Then he began to wonder how dangerous it was to argue with a madman.

Horner looked harassed. "I think you're forgetting something, Mr. Gillespie." Gillespie had been a management major and so had no real training in the sciences, but Horner couldn't be sure. "No system reacts instantaneously to a change. When you turn off a light, the power still in the line must be used up, and the heat in the filament must be dissipated. When you turn off a TV set, the picture doesn't instantly disappear. Any system must have time to react—as a whole—to a stimulus."

"Of course," Gillespie covered up, looking as if he'd bitten into a slice of lemon. And no tequila.

"If Harry and Phil turn off the system, it'll surge again—explode—before it returns to zero energy production."

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"So that's what's worrying you," Gillespie said, relaxing. "You think that even with the new set-up Harry and Phil can handle only the generated energy, but not your so-called shutdown surge. You're afraid they'll be hurt and the company will lose valuable equipment. Commendable, son. Commendable."

Perhaps he wasn't alone in a room with a madman after all, merely with a misguided one.

But Horner's weak nod of agreemen twasn't reassuring. "Yes. That's partly it."

"Partly?" It was Gillespie's turn to stand up. That way he could get a quicker start towards the door.

Horner ground his teeth. "According to my figures . . ." and he hesitated.

"Yes? Yes?" Gillespie was partly caught up in Horner's obvious concern, mostly in his own alarm. Where would this farce end?

"According to my figures, we have to take two new things into account. First, the amount of energy freed by our new process is a function of both mass input and time. We shut it off so quickly that first time that the time increment was very small. So X^2—plus change. as *Generally Unclear* put it—was close enough. But if I'm right . . . Well, maybe you'd better check it out with Harry and Phil. Then I'll tell you the rest."

Gillespie did so. "Harry? Gillespie. How long you been running now? Nearly nine minutes, huh? And what's your output holding at? What do you mean, you don't know?" He waited. "Oh." He covered the mouthpiece and spoke to Horner with a new respect. "Harry says the output is increasing. Only they think it's some kind of malfunction in the meters because they're holding the mass input steady." He removed his hand and spoke to Harry again. "Give me your first nine minutes of output readings anyway, would you?" His nylon-tipped pen squeaked as he jotted down figures. "Hang in there, Harry. I'll be getting back to you."

Gillespie set the receiver carefully in its cradle. He noted that his hand did not shake. He tore off the sheet and slid the figures across to Horner. Then he put his fingertips together and sat back in his chair. Maybe he should hear Horner out, just in case.

"And the second new thing?" he prompted.

Horner forced himself to look up from the figures. "The size of the shutdown surge. Let E equal the energy we actually get out of this thing. Then E is proportional to time *t* since the initiation of the process times the square of what we thought we'd get. That is, $E = t(X^2)$. With me?"

Gillespie didn't hide his irritation. "Of course. I'm not stupid."

Horner was too intent to be embarrassed. "Well, according to my figures, the shutdown surge—let's call it Y—is proportional to E^2."

He paused to see if Gillespie would get it.

Gillespie stared at the ceiling where the front wall and the left side wall met. He patted his fingertips together for a few moments. Then he stopped and said, "O my God."

He'd gotten it. Horner nodded his approval.

$Y = E^2 = (t[X^2])^2$. In effect, you

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couldn't shut the damn thing off. And the longer you went without shutting it off, the worse the shutdown explosion would be.

Horner and Gillespie both sat very still for what, under the circumstances, seemed to both of them like a very long time.

Finally Horner went back to the increasing-output figures on the sheet Gillespie had given him.

Gillespie had begun to sweat. "What if we cycle the input slowly down to almost zero, and then shut it off?" he suggested.

Horner began to like Gillespie. At least the man was working on it. And maybe he had come up with something. But . . . no.

"I don't think it would work," he said with some regret. They had to do something, and soon. The time factor was getting larger every minute. By definition. "There's too great a chance that it's the reduction in input that causes what we've been calling the shutdown surge. Reduction to zero is obviously shutdown. But *any* reduction might cause a similar destructive surge. We can't risk it."

Gillespie nodded forlornly and went back to sweating and patting his fingertips together. Horner added his pocket calculator to his notepad and began figuring again.

Time passed. Or, rather, t increased.

Finally Gillespie slapped his desktop with both hands. The mini-explosions got Horner's attention.

"We'll have to cut our losses, that's all," Gillespie announced. He punched the intercom button too hard.

"Yes, sir," it replied, ignoring his violence.

"Mrs. Bloomingtree," he said authoritatively, "have Security clear the plant and its neighborhood for a radius of . . ." He looked the question at Horner, who shrugged in his ignorance and went back to his calculations. Big help in a practical matter, these theoreticians. ". . . a radius of half a mile. Tell them I want it done in fifteen minutes. You too, Mrs. Bloomingtree."

"Sir?"

"Just do it."

He punched her out, then called Harry and Phil.

"Harry? O.K., this is Gillespie, and this is the way we're handling it. Rig a timer to shut down the mass input in fifteen minutes. Then you and Phil clear out as far as you can. No, we don't have time to talk about it. Just do it." And he hung up. A man of action in action.

To his notepad and calculator Horner added some wrinkled papers from his manila folder. Gillespie's palms got wetter. He wondered when . . . and how . . . to suggest to Horner that they too had perhaps best be leaving.

The phone buzzed. It gave him something to do.

"Gillespie. Oh, hi, Farrell." Security. "What do you mean, you can't clear out the plant and neighborhood in only fifteen minutes? How long then? An hour minimum! If you're lucky? But . . . but . . ."

Horner reached over and waved a hand in front of his face.

"I'll have to call you back," Gillespie admitted.

"Look," said Horner, "we don't know for sure how drastically time af-

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fects all this, and using only nine minutes of data for this kind of projection is crazy. But we don't have any choice. We've got to get this situation under control."

Gillespie felt like tearing out what little hair he had left. "Tell me something I don't know." Hitting Horner probably wouldn't help.

"I'm sorry, Mr. Gillespie, but according to my figures, in the time it takes to clear a given area, enough explosive force would almost certainly build up to destroy an even larger area. I don't think you can get ahead playing that game."

Why wouldn't hitting Horner help? Gillespie wondered. At least it would be something physical and positive he could do.

"If you shut it down now, you'd probably only lose St. Louis," Horner went on unhappily. "But eventually, if this thing were ever to be shut down for any reason, it could . . . uh, blow up the world. Not now. Not next week. But eventually. That's the future risk you'd be taking. St. Louis—and you and me—now, or the world tomorrow. It's your choice, sir."

Gillespie put his head on his folded arms on his desk. Horner sat staring at him. They remained very still for a very long time. They were both intensely aware of the passage of that time. Each tick of the clock added tonnage to the bomb accumulating across the way.

Realistically, the world could probably get along without St. Louis. And without them. *t* continued to get larger. Perhaps the world would also have to get along without the eastern half of Missouri and the southern third of Illinois. Of course, there would be all that inconvenient fallout across the northeast. And climactic changes wrought by the millions of tons of dirt and concrete powdered, heated, and flung into the atmosphere. The northern hemisphere would see glorious sunsets for years.

The consequences of turning their device off had become appallingly serious. As had the consequences of leaving the damned thing on. What to do? What to do?

The phone rang again. Gillespie picked it up. He did not raise his head.

"Hello," he said to the inside of his left elbow.

"What?" His head came up.

"What?" His back straightened, and he sat up.

"What?" He stood up.

"All right, all right, Harry. Calm down. I'm glad you didn't rig that timer. It's O.K. Everything's O.K. I know what we're going to do." He was actually dancing with relief. "We've got it whipped!"

He tossed the phone toward its cradle and missed. He came around his desk and hugged Horner. His smile was radiant. Horner looked at him sideways.

"Harry wants to know what to do with the excess energy. He can't store any more of it. To use it up, he's got all the lab equipment running. He's had to ask the power company to stop feeding us. Instead he's had to switch it over. Now we're feeding them."

Horner was beginning to catch Gillespie's enthusiasm without quite understanding it. He smiled cautiously.

"You see it, don't you?" Gillespie insisted, his hands on Horner's shoulders, his eyes glowing. "We won't have

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to turn it off after all. We just have to use it."

"But . . . but the danger. The shutdown explosion!"

"The hell with the danger. It was safer to walk than to ride horseback, but we didn't care. It was safer to ride horseback than to drive a car, but safety wasn't the point. The point was freedom, and quality of life, and that means energy."

Gillespie strode several times back and forth across the room. "How much energy do you think we're eventually going to get out of this thing, maximum?"

"It seems to be getting more and more efficient as it goes along. That's why we're getting more output all the time with the same input. I don't really see why it should stop until the mass being put in is being converted 100 percent into energy."

"And when will that be?"

Horner shook his head. "I haven't figured that out yet. I've been projecting the growth rate."

"Tell me about it."

Horner knew his figures were based on woefully inadequate data. But still they showed . . .

"Maybe a quadrillion BTUs in ten years at our present rate of feeding mass into the converter—and I think it would be too risky to change that. Then nearly a doubling of our output every decade after that—until 100 percent efficiency is reached, of course. Then it would level off."

"So despite the doubling every ten years, it'll never become infinite? That's one nightmare we'll never have to face?"

"No, sir, no way. And according to my figures, in eighty years our company could be supplying all the energy the United States now uses each year, and in less than a hundred years we could supply all the world's energy needs at its present rate of usage. Of course, the world's energy usage will go up drastically. Besides us, it'll still have all the energy sources that are now on line and in use. We've just given the world all the energy it'll ever need."

"Ever?" Gillespie was taken aback. The claim seemed excessive.

"Of course. When this one levels off, we'll know a hell of a lot more than we know now, and we'll build more of them. In space, of course, where we'd have built this one if we'd only known. The new ones will be a lot safer."

Unlimited energy. For the rest of human history.

They looked at one another with a wild surmise.

All the world's physical problems —poverty, famine, disease, war—all of them would be solved, given enough energy. They had just made everyone in the world rich, and well-fed, and healthy, and mobile. The risk of shutdown disaster was balanced by the increase in the amount of freedom that risk made available to every man, woman, and child then alive or yet to be born. If they turned their energy source off—at the cost of St. Louis, Missouri, Illinois, western Kentucky and Tennessee, northern Arkansas, and themselves—then they would be enforcing the poverty and misery of billions who, given the choice, would surely not choose to be poor and ill, and who, given the choice, would surely not

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choose to endure having to watch helplessly while their children sickened and died. Surely, Gillespie and Horner convinced themselves, the risk was worth the gain. The alleviation of all that human suffering was worth the danger.

Horner by now was also smiling broadly. He was proud. He had helped give the world its new, clean, efficient energy source. Soon each person on Earth would have access to as much energy as each American did, and who could deny them their right to it? And that meant . . .

The horrors and human misery expected by the end of the twentieth century had been avoided.

When everyone had energy to burn, everyone could share in the American standard of living. Comfort. Education. Leisure. A lowered birth-rate.

Non-polluting automobiles. Non-polluting industry.

Electric appliances in every home around the world.

"A toaster in every kitchen," Gillespie chortled.

"And enough bread for every toaster," agreed Horner.

"Conspicuous consumption is the only answer. All that energy is going to have to be used."

"Either that," Horner agreed quietly, "or the world blows up."

The other side of their vision began to haunt them.

Gillespie perched on the edge of his desk and chewed a fingernail. "Everyone on Earth is going to have to use energy whether he wants to or not, just to stay alive. It'll be each citizen's duty, and the governments will have to enforce it."

"Electric meters on every home and building in the world," Horner predicted, "so the government can check to see that everyone is using his quota."

"Odometers on electric automobiles," added Gillespie, "so the government can be sure everyone is driving his required 300 miles a day to run the batteries down so they'll need recharging."

"Short circuit them," Hoerner suggested morosely.

"Yeah," Gillespie grinned without humor. "Someone will think of that." Then he became serious again. "How about gigantic resistors? Then—"

"O my God!" Horner said suddenly. "That's another problem we hadn't thought of. All that energy is going to mean an awful lot of heat."

"Heat?"

"Of course. The number one by-product of energy usage is heat. The same energy that will free all of mankind will also heat up the world, melt the icecaps, change the weather, the food supplies, geography."

"Oh," Gillespie said.

"Yeah," agreed Horner. "Oh."

They sat back down. A few moments ago they had been enthusiastically condemning everyone on Earth to living as an American, to spending the major portion of his time consuming the now-available energy.

Now they faced an entirely different problem. How does everyone on Earth use as much energy as an American —how does everyone on Earth achieve the standard of living of an American—without destroying the environment? Did any American or group of Americans have the right, in consci-

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ence, to tell the rest of the world it would be too dangerous for its inhabitants to live as Americans lived?

From his right-hand desk drawer Gillespie retrieved two glasses and a bottle of good Scotch. When they had emptied and refilled the glasses, Gillespie asked, "Do we shut it off?" Which meant: Do we take it upon ourselves to deny the rest of the world a higher standard of living because there are risks and problems involved?

Horner thought about enforced energy use and about heat. He looked into his glass and quoted, somewhat inappropriately, "In vino veritatis." And then he laughed. "O ye of little faith. No, we don't turn it off. Because there are solutions to problems, but they're not found by running from the problems. And man has always been a problem-setting as well as a problem-solving animal. Tired and befuddled as I am, I can think of a direction to look in to solve the heat problem. Surely others, with more time and more data, can think of some things too."

Gillespie didn't ask. He simply raised his eyebrows.

Horner leaned across the desk in mock-conspirator fashion. "If we don't want all that heat on Earth, then we won't keep it on Earth, that's all. The Earth isn't a closed system, and there's not just one Earth. It's a part of the universe."

"So how will we get the heat off the Earth?"

Horner twirled his glass slowly and finally whispered, "We'll build gigantic microwave transmitters, and we'll beam out into space the energy we don't want or can't use. Eventually we can build receiving antennas and power our near-Earth industries with Earth-Powered Satellites."

Gillespie laughed. "That's outrageous."

"Exactly. But who cares? The point is, we'll think of something. We always have." ■

THE COMPLETE INDEX TO *ASTOUNDING/ANALOG*

It finally exists: something that many of you have been asking for for years. Mike Ashley has compiled a complete index of the first fifty years of this magazine, just published by Robert Weinberg Publications and now available from the publishers. I have a copy in front of me as I write this, and it's a monumental piece of work. In addition to the author and title indices you'd expect for both fiction and nonfiction, the book has special listings for series, art, and letters, plus complete issue-by-issue contents (including An Lab scores) and a variety of special features on such things as "The People Who Brought You Astounding/Analog" and "The Analytical Laboratory."

So far the book is available only in a limited hardcover edition (library binding, no dust jacket) of 500 copies, priced at $29.95 and available only from the publishers. (However, I suspect that if demand sufficiently exceeds supply, there'll be another printing to meet it.) Send your orders and payment to: Robert Weinberg Publications, 15145 Oxford Drive, Oak Forest, IL 60452.

The Editor

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Gary Alan Ruse

JOLLY ROGER

If the past can be changed,
time travel must be strictly regulated. Enforcing the
regulations is—ah—interesting work...

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"It's a conspiracy!" Gus McAbee said hotly. "An ever-lovin', bleep-freeping conspiracy!"

"You're overreacting," his partner said soothingly. Zane Kirby was good at soothing reassurances. He needed to be. "You should consider it an honor, really. They always try to pick the best man for the job, and you can't deny you've demonstrated a remarkable talent for adapting to new host forms on our previous assignments."

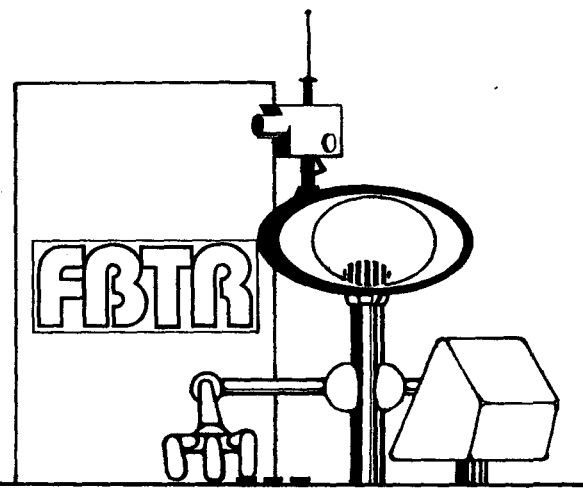
"Bilgeblather! I haven't done anything *you* couldn't do, given the chance. The truth of the matter is, the commissioners don't like me. They've *never* liked me. I'm too much of a nonconformist to suit their bureaucratic sense of taste, and this is their way of punishing me."

"Let's not get paranoid, now." Kirby gave him a comradely pat on the back, but in his private thoughts he had to admit there was a certain element of truth in what his partner said.

Gus McAbee *was* a nonconformist, at least in the eyes of their superiors at the Federal Bureau of Temporal Regulation. In contrast to Zane Kirby's sleek-as-always appearance, McAbee's orange tweed zip-suit was rumpled and dowdy, and his auburn hair, no matter how often combed, always looked as if he'd just awakened from a restless night's sleep. And as for the way he followed procedural guidelines set forth by the Bureau? Well . . .

It was only his astonishingly good record of success as a trans-temporal agent that kept him on with the FBTR. That, and the fact that he and Kirby made a heckuva good team.

"A conspiracy," McAbee was still muttering as the two agents made their



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way down the tenth-floor hall of the Bureau's national headquarters. "They always hit *me* with the freak jobs. Just once, I'd like to go on an assignment in my own skin."

"Now, now. I'm sure you're to play a vital role in this mission."

"Billydiddle! They haven't even told us what the freeping assignment is, yet. All they said was to report for preparation."

Kirby sighed inwardly as they reached the two doors that would separate them momentarily. To the left was his door, leading to the costume, artifact, and old currency section. To the right was McAbee's destination, the biological storeroom and mind-transference chambers.

McAbee gave a slight shudder of anticipation at the prospect of what awaited him, then drew himself up with a sense of stoic resolve and displayed his identocard to the door scanner. In the last moment before he disappeared inside, he turned to Kirby with a bit of a sullen pout and said, "It's probably because you're so blasted good-looking and I'm not." And then he was gone.

Kirby shook his head ruefully and entered his own door.

The elevator that traveled up to the commissioners' offices a half hour later bore two rather remarkable passengers. Zane Kirby stood jauntily attired in faded brown breeches that barely reached to a pair of floppy boots whose tops were rolled down. A loose-fitting white shirt covered his upper torso, and a scarlet bandana was tied stylishly about his head. Tucked into his wide belt was a flintlock pistol, and hanging at his side was a cutlass that looked like a museum piece. It was outlandish dress for modern times, but Kirby, as always, carried it off like a trouper.

The other passenger was quite another matter.

Perched on the car's handrail in a pose of monumental ill-humor was a large green parrot with yellow markings and a bright orange beak. Kirby hadn't seen the bird before, but there was something about the glaring eyes that was all too familiar. Without thinking, he smiled to himself.

"Not one word!" said the parrot. "Not even a syllable! And if you know what's good for you, you'll wipe that ever-lovin' smile off your face!"

"How about a *poly*syllable?" Kirby asked. "Sorry, Gus. It was thoughtless of me." But he couldn't quite stifle a chuckle.

"You think it's funny, huh?" Gus said hotly. "How'd you like to go off and leave *your* body squatting on a king-sized perch, naked as an ever-lovin' jaybird, with nothing to eat but sunflower seeds and apple tidbits?"

"That's right, I forgot. The parrot's mind is in charge of your bod while you're using his."

"Some trade," Gus said. "I just hope the bird-brain doesn't try *flying*."

The elevator doors whisked open on the twenty-third floor and Zane Kirby stepped out. Gus McAbee's newly acquired parrot form flapped awkwardly out after him and landed on his shoulder. Coming toward them down the hall was another of the FBTR's top agents, the ever-delectable Angela Devane. She glanced at them and gave a cheery salute.

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"Hi, Zane!" she said briskly. "How's it going, Gus!"

"See! See!" McAbee's parrot voice was far too close to his partner's ear for that kind of volume. "Even *she* knows I'm the one who always gets stuck with these switcho jobs!"

"Calm down," Kirby said, and tried to change the subject. "You know, it's really an amazing process. I still don't see how they manage to fit your human mind into a cranium so small."

"Ha!" Angela chortled with a toss of her golden curls. "I'm sure there's room to spare!"

"Kick a man when he's down," Gus retorted, but Angela had already disappeared into the elevator.

Kirby still stared wistfully after her, contemplating the vision she made in her trim-fitting yellow zip-suit. "She's really something. Wouldn't you love to be teamed up with *her* on an assignment?"

Gus shifted his weight from one clawed foot to the other. "Fat lot of good it would do me." Using his beak, he tugged sharply on his partner's ear to bring him out of his fantasy. "Move it, Casanova. The boss is waiting, and the sooner we get this job done, the sooner I get back to my own ever-lovin' frame."

They reached the end of the hall and the reception robot buzzed them on through to the inner offices of their immediate superior. As the door whisked open before them, a tall, bearded, stout man of Falstaffian look and epicurean manner bade them enter.

"Ah, yes! Agents Kirby and McAbee—come in, come in." Motioning them in with a wriggle of his pudgy, ring-covered fingers, Commissioner Hughesford Sheffield waited until the door closed behind them before saying, "Now then, I imagine you're curious to learn what your assignment is this time."

"No, don't tell me," Gus said from his partner's shoulder. "Let me guess. You're sending us back in time to infiltrate the cast of an Errol Flynn movie."

Sheffield raised a disdainful eyebrow. "We'll have none of your petty sarcasm, Agent McAbee. I'll have you know this is a highly serious mission you're about to undertake."

"Then why send me off in feathers?"

"I've explained this all before," Sheffield said with polite impatience. "People, especially those in the past, don't expect a lesser animal to have human intelligence or capabilities. Therefore when one of our team operatives is sent out in such form, he has a special advantage that makes him more effective. Your record thus far has certainly proven that to be the case."

"Doodlepiffle."

"I beg your pardon—?"

"I said," Gus intoned meekly, "do go on, if you will."

"Yes, of course," Sheffield said skeptically. "Now, the problem, as so often before, is a case of illegal trafficking of merchandise through time. But in this case there's far greater danger of historical alteration than usual."

"What kind of merchandise?" asked Kirby.

"Some Vietnam-era weapons and ammunition that disappeared from an armory back in the 1970s. And quite a lot of them, if our intelligence report is accurate. One of our operatives in the

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Educational Interface Division thought he spotted them on the island of New Providence in the Bahamas of 1717, while he was escorting a cultural anthropologist on a research trip."

"Hard to believe," Kirby said. "Moving that much mass through the space-time continuum . . . wouldn't our scanners have picked up the criminal's time machine?"

"Oh, pish and tush. Some of these new Japanese models barely make a ripple. Besides, our scanners are far from perfect."

"Among other things," Gus said under his breath, then pretended to preen as Sheffield's sharp gaze fixed upon him.

"I guess that could stir up quite a ruckus in 1717," Kirby said quickly. "What government are the weapons headed for?"

"None of them, as such." Sheffield folded his arms across the broad slope of his upper torso. "As near as we can determine, the man who took them there plans to sell them to the pirates inhabiting the region, in exchange for gold doubloons and other looted valuables which have immensely higher selling prices in more recent time periods. Naturally, the prospect of having the pirates of that era outfitted with what are, for them, highly advanced weapons poses an enormous threat. If they should organize, they could easily become a new center of power and radically alter the course of events there and perhaps throughout the world. Why, our computers are going *crazy* trying to calculate the possible historical permutations!"

"Do you know who the crook is?" Gus interjected.

"Oh yes indeed," said Sheffield, reaching over to his desk to touch a switch. Without turning to look, he gestured over his shoulder at the presidential portrait on his wall. "There he is, gentlemen. Beady-eyed little devil, isn't he."

Zane Kirby studied the picture with surprise. Gus McAbee said, "I thought you voted for him."

Sheffield whirled as fast as his bulk would allow and frowned as he saw the portrait still there. Rapping his desk switch several times, he muttered, "Drat! Thought we had that fixed."

There was a faint click and a buzz, the president's officious smile vanished, and the display screen which doubled as a governmental wall-hanging revealed a new image. It was a front and side view of a man who might be middle-aged, or might be younger. One of those faces that was hard to pin down. Kirby thought to himself that the man didn't really look quite so beady-eyed as Sheffield had suggested. He had a round face and a pleasant smile, and a shock of wispy hair that hung down almost to his eyes. It was either the kind of face that you trusted implicitly, or the kind of face that should *never* be trusted.

"His name," said Sheffield a trifle peevishly, "is Roger Turnbuckle. We managed to identify him with a cross-check through the interagency intelligence system. No convictable crimes, yet, but he has had more than a few brushes with the law. He's more of an opportunist than a conventional criminal, but I still must caution you not to take him lightly."

"Wouldn't it be easier," Gus sug-

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gested, "if we just hopped back to when he was a couple years old and gave the tyke a bargain-rate frontal lobotomy?"

"A tempting thought," Sheffield said with a sigh. "But you know as well as I the regulations governing the conduct of trans-temporal agents. Time-tampering is time-tampering, no matter *who* does it. Besides, there's still a chance to undo the harm in a more direct manner. Figuring on a real-time basis, the weapons haven't been there in 1717 long enough to cause any irreversible changes yet."

Kirby was fiddling with the rakish tilt of his bandana. "So you want us to round up the weapons and bring Turnbuckle back to face charges of time-smuggling?"

"Precisely." Sheffield handed him a data folder and hit the switch which opened his office door. "Now brush up on the period information in there, and report to the transmission center."

As Kirby made his way out of the office and down the hall to the elevator, he thumbed through the data folder to refresh his memory of the period and location. Everything they would need to know to get by was briefly and concisely listed. It was not so much like a history book as a Fodor's *Guide*. Glancing to his shoulder, Kirby couldn't help being amused by the sight of the large green parrot studiously peering down at the information.

"Well, do you want to prepare any more," Kirby asked, about to dissolve into laughter, "or do you just want to *wing* it?"

"Crack all the jokes you want, wise guy!" Gus told him. "Have your fun at my expense. But just you wait and see what I do to the back of your ever-lovin' shirt—!"

"I don't like your face, Mate!" said the big Cockney pirate. "And the same goes double for your bloomin' bird!"

"Can't say as I like it myself, at times," Zane Kirby replied as the pirate took a fistful of his shirtfront and yanked him forward for closer inspection. "Especially now."

The two trans-temporal agents had materialized near the center of the bustling settlement on the island of New Providence amid evening darkness. Although this spot near the harbor at the island's northeast coast would in later decades become the city of Nassau, it was for the moment just a sprawling and haphazard colony of outlaws, cutthroats, and unscrupulous tradesmen. Crude sailcloth tents and driftwood shacks were the order of the day, and the tavern outside which they now stood was only a little more permanent. Coarse voices within sang lusty sea chanties and various assorted bawdy ditties, and it struck Agent Kirby after only a moment's reflection that this was a particularly poor place to spring into view. Especially since that spring had brought him into jarring contact with a decidedly muscular pirate who was long on drink and short on temper.

"I've seen your like before, Mate," the pirate went on, his breath moist and very nearly flammable. "A bloomin' aristocrat what thinks 'e owns the world, bargin' about and bumpin' into blokes."

Kirby noticed that Gus had already departed for safer regions, and was hoping to do the same himself. He thought of the flintlock pistol in his belt. Within

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its historically accurate outer shell were the electronic guts of both a stun gun and a laser, and at the moment he wasn't too fussy about which he might use. But the opportunity did not come, since the big Cockney quickly shifted his grip to the scruff of Kirby's neck and the seat of his pants and hurled him bodily through the open door of the tavern.

"Next time—" bellowed the pirate in mid-fling "—watch where ye be goin'!"

Kirby sailed over three rickety tables that were thankfully unoccupied, collided with a slender pirate of boyish build carrying drinks to the customers, and collapsed in a heap of flailing limbs and clattering cups. As he lay there trying to regain his breath, Gus came flapping over and landed on the back of a nearby chair.

"Great show, Zane," he said. "You fly better than I do."

"Thanks a lot for your help," Kirby muttered. "You could have at least bitten him."

Gus did his best to make a face. "Frankly, he didn't look like the sort of thing I'd care to sink my beak into."

There was an outraged, muffled gasp, followed by a string of vile epithets, all of which issued from the slender pirate squirming beneath Kirby's sprawling form. As Kirby appraised the pitch of the voice and the peculiar softness of said pirate, he realized quickly that he had made a gross error in judgment. There was nothing boyish about *this* particular buccaneer!

He swiftly got to his feet and helped the girl up, despite her attempts to avoid his aid. The rowdy crowd surrounding them seemed momentarily amused by the incident, but quickly returned their attention to their drinking and their singing.

Zane said, "Gee—I'm sorry!"

"Sorry?" the girl said, angrily brushing dust from her clothes. "*Sorry?* Sorry's what you'll be after I've found my cutlass and hacked you up into small, bloody bits!"

"You've found a real charmer," Gus said as he flew past Kirby and kept going.

The girl looked up with eyes flashing. "Who said that?"

"A yellow-breasted big mouth," Kirby told her. "And I really *am* sorry I fell on you like that."

The golden lamplight bestowed a certain romantic mellowness to even this seediest of places, and now that he had gotten a good look at her Kirby was surprised he had mistaken the girl's gender in the first place. It must have been the clothes. She was wearing men's breeches, a baggy shirt whose sleeves ended in tatters above the elbows, and a pair of soft leather boots small enough to fit her feet and calves trimly. Her hair was cut short in a boyish bob, and was as dark as her pretty eyes. As she studied Kirby's own appearance more closely now, some of her anger seemed to fade, although she still was clearly annoyed.

"Just look at this mess!" she said. "And you've spilt my friends' drinks."

Kirby fished in his pocket for one of the coins the Bureau had supplied. "Then buy some more on me."

She stared at him a moment, uncertain, then snatched the coin from his outstretched hand. As she tested its hardness between her teeth, Gus flew back into the tavern and landed on the

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table beside the girl. In his beak was a wildflower plucked from the untended flora outside, and waddling up to her, he laid the bloom down near her hand.

"Awk!" he said in perfect parrot fashion. "Pretty! Pretty!"

The pirate girl blushed, picked up the flower and reflexively sniffed it. When she saw Gus fly up to perch on Kirby's shoulder, her hard look softened a bit more. "Well, at least your parrot's a gentleman. I suppose I may not kill you."

Kirby said, under his breath, "Good thinking, Gus."

The girl reached up to scratch the parrot behind its neck. "Can't say as I've seen either of you here before."

"Never been here before," Kirby told her. "Just arrived today, and I've worked up a sailor's thirst. Where's the proprietor of this tavern?"

"Right here. The same as who you fell on so handily. This place, such as it is, has been all mine since Father took a fever and went to his reward. Since you're buying, you may as well come join us if you've a mind to."

The girl, who Kirby estimated to be about seventeen or eighteen, quickly ladled out more drinks from a large mixing bowl and escorted him to a rear corner where her friends waited. As she set down the tray, the half-dozen or so pirates gathered around the table helped themselves to the cups with hearty approval.

Kirby took one himself and sat down. "My name's Zane Kirby," he told the girl. "What's yours?"

"Higgins," she said, somewhat defensively. "Sally Higgins."

"Aye," the pirate to Kirby's left confided with a grin. "But 'tis Sally Boots we calls her. For her fondness for fancy footwear."

Sally's temper flared. "You're an alliterative old sot, Tom Oakes, and a gossip besides!"

Oakes was lantern-jawed and grizzled, and as he roared in laughter his teeth looked as if they'd been whittled by a rough hand and a rougher eye. To Kirby, he said, "Such pretty words! 'Tis said her lovin' father was a man of books afore he turned rogue like the rest of us, and the learnin's rubbed off on her."

While Sally fumed at her friends' merriment, Kirby thought it better not to comment and instead took a speculative taste of his drink. It was surprisingly sweet and more than potent enough.

He swallowed hard. "What *is* this stuff?"

"A simple sailor's punch," Sally told him. "Spirits and water, lime juice, sugar and spice. And it's finer 'stuff' than the belly vengeance they brew on the rest of the island."

"No doubt it is," Kirby muttered appreciatively. "Sort of like Kool-Aid with a kick."

The girl frowned. "Cool what?"

"Nothing. Just something I tried in another place and time."

"Ahem!" said Gus, and dug his talons into Kirby's shoulder.

"Sorry." Kirby held the cup within the parrot's reach. "Go on and have a taste."

Gus took a beakful and swallowed, then discovered his avian palate was far less accustomed to strong drink than his human one. His eyes rolled and his feathers ruffled, and with a bit of a

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cough and a raspy voice, he said, "*Yo, ho, ho, and a bottle of rum!*"

"So he talks, does he?" said Tom Oakes.

Kirby nodded. "Far more than I like." Gus dug his claws in again, this time for spite, and Kirby said, "But enough about him. I'm hoping to do some business with a man here. Name of Roger Turnbuckle. Maybe you've heard of him—?"

"Maybe we have," replied Sally Boots, her mood suspicious once again. "And maybe not."

"Be he a friend of yours?" asked Tom Oakes with sobering interest.

"A friend? Hardly." Kirby sensed the diminished humor in those around him. This was no time for careless words. "Never even met the man. But I've heard it said he has some merchandise worth seeing."

"Can't say as I know what merchandise he has," Sally told him, "but he's been putting together a ship and crew, and making bold promises as to the benefits for those who follow him. But he's a stranger, with strange ways, not unlike yourself, I might add. He talks a good show, but those of us here don't entirely trust the man. Might you be interested in sailing with him?"

There was more lurking in the question than idle conversation, and Kirby felt all eyes on him. "No. I can honestly say that helping him is the very *last* thing I want to do. Helping myself is more what I had in mind, if you catch my meaning."

"Aye!" Tom Oakes's smile returned. "Here's a man after me own treacherous heart. Well, if you're no friend of Turnbuckle's, then maybe you'll cast your lot with us. We've a few schemes of our own as regards the rascal, and we could use an extra hand."

Kirby considered it. Aligning themselves with Turnbuckle's competitors might be more restrictive than investigating on their own, but it also offered the advantages of knowledgeable escorts and protective cover. "All right. Count me in. But what do we do?"

Sally leaned forward and in a hushed, conspiratorial tone said, "We've learned his crew sets sail on the morning tide."

"Aye, looking for merchandise consigned to them," said Tom Oakes. "Cruising for prey. And if she be as rich a prize as the man has sworn, then maybe there be plenty to go around."

"Sounds promising." Kirby turned to the parrot. "What do you think, Gus?"

"Awk!" said Gus cheerily. "More grog!"

"Serves you right," Kirby told Gus at dawn, as clouds came scudding across the pink-streaked sky. He stood on the beach near the longboat that would take them out to the three-masted sloop recently "acquired" by Sally Boots and her fellow buccaneers.

"Must you talk so loud?" the parrot said, hunched there as he was on Kirby's shoulder, his feathers in a disorderly state. "Besides, I didn't drink as much as you."

"If you figure it proportionately by body weight, you had ten times as much," Kirby told him, then lowered his voice as the parrot cringed again. "Anyway, the real problem now is Turnbuckle. He's obviously not plan-

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ning to *sell* his weaponry as we thought. He's planning to *use* it."

"I still vote for the lobotomy."

"This really puts the pressure on," Kirby said, ignoring the remark. "A lot of disorganized pirates with advanced weapons is bad enough. A man like Turnbuckle leading them, knowing what he knows, is a heckuva lot worse."

"Stow it," whispered Gus. "Here comes the scourge of the Spanish Main."

Sally Boots came marching toward them from the settlement, her friends following with far less military bearing than she. She had changed her tattered garments for what must be her working clothes—fine black breeches and a black coat with flaring tails, gold buttons, and ribbons, apparently liberated from some smallish dandy unfortunate enough to have crossed her path. A good shirt was tucked into those breeches and circumnavigated by a broad purple sash from which a matched set of pistols protruded. Purplish knee-high boots lent credence to her nickname, and atop her head was a cocked hat sporting a purple plume that swept down in an arc to tickle her chin. And, Kirby noticed with some concern, a very businesslike cutlass dangled at her side.

"I'm glad to see you're ready early," she said as she reached Kirby. "Since you're new with us, I should tell you that old Tom's our quartermaster and our sailing master besides, so for now you'll take your orders from him. I'm the captain."

Kirby mulled over the information. He knew from his briefing file that captains, like all pirate officers, were freely elected, and were only in command in time of chases and battle. The captain was, in short, the crew's military specialist. Kirby couldn't help raising an eyebrow as the girl passed him and boarded the longboat.

"Captain?" he mused aloud.

Tom Oakes gave a shrug. Shielding his words with the back of his hand, he confided, "She couldn't sail her way out of a bucket, but when it comes to a fight she be better'n any man among us. Ye'd best stay on her good side, lad."

"Thanks," Kirby said. "I'll try."

They boarded the longboat and rowed out to the sloop in a matter of minutes. Kirby was thankful that his FBTR training had included, among many other things, basic seamanship. Gus was thankful he didn't have to row, and that the sea was relatively calm.

As they clambered aboard the sloop, which Sally Boots had rechristened the *Unicorn*, one of the dozen pirates who had stayed aboard the vessel pointed to the mouth of the harbor and said, "Turnbuckle's ship—it's heading out."

"Step lively, lads," Tom Oakes ordered. "Let's up anchor and see where they be heading."

Zane Kirby quickly adapted to the slight rocking of the deck and grasped the anchor line with both hands. "Well, let's heave ho!"

"Oh, God," groaned Gus, suddenly greener than usual. "Don't say that—"

Two hours' sailing brought them around the northern end of the island and well into the Florida Straits, through which all shipping taking the northern route back to Europe had to pass. The *Unicorn* followed close enough to Turnbuckle's ship to keep it in sight, but not

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so close as to attract undue attention. The ploy had worked well enough at first, but now something was definitely amiss. They were catching up to the first ship at an alarming rate.

"She's struck her sails!" Tom Oakes said. "Dead in the water she be!"

Sally Boots strode to the gunwale to peer out across the waves. "But why? Have they run aground on a reef?"

"Not in these waters, lass. They've stopped for a reason, even if I don't know what the reason be."

Zane Kirby was looking at an object almost hidden by Turnbuckle's craft. "Maybe it has something to do with that other ship."

"Other ship?" said Sally, extending a spyglass and putting it to her eye as she spotted the vessel herself. "Yes—I see it! A Spanish galleon, sailing toward us like a fat goose! A merchant ship from the look of her."

"Probably loaded with goods from the Spanish colonies," Tom Oakes said. "A prize fit for taking. But Turnbuckle won't catch her with his sails down."

Sally Boots telescoped her spyglass and took a decisive stance. "Well, if he won't take the prize, *we* will!"

"Marvelous," Gus muttered. "Do the regulations permit us to participate in an act of piracy?"

"Maybe," Kirby said. "As long as we don't unduly influence the outcome one way or the other."

"In other words, we can be pirates as long as we're mediocre at it?"

They passed Turnbuckle's ship on the starboard side. It looked to be a fifty-ton sloop, and was a good hundred yards away. Kirby tried to see if there was any activity on deck, but the vessel, like so many that were modified for pirate use, had raised gunwales that blocked his view. He thought he could make out a number of hoists rigged on the vessel's far side, but couldn't guess their purpose.

"Get ready to raise the flag, Mates!" Sally ordered, clearly assuming command now. "And stand by with the boarding pikes!"

While Tom Oakes prepared to run up the black flag with the white skull and crossed bones, the gunner's mates were loading powder, shot and scrap iron into the craft's falconets. Kirby didn't relish the thought of what that murderous combination would do to the crew of the Spanish vessel if combat erupted in lieu of a peaceful takeover, but there was nothing he could do. The regulations were explicit concerning interference in the activities of temporal natives. Even with the vast computer facilities of the FBTR, there were just too many variable factors to risk doing or undoing something that might change history.

They were sailing northwest now, heading on an intercept course with the galleon. The Spanish vessel was ahead of them, but its lumbering hulk could not conceivably escape the faster pirate craft. In fact, they were closing the gap with admirable ease when suddenly from behind them came a new and alien sound rising above the snap of canvas and the lapping of waves.

"What's that freeping noise?" said Gus, craning his parrot's head in the direction of the sloop's stern. Then he found himself hanging on for dear life as Kirby dashed to the rail to look for himself. "Zane! Take it easy, will ya? I'm having *enough* trouble keeping the

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old biscuits down."

"What is it?" Sally Boots said as she joined them at the rail.

Before Kirby could frame an answer, the source of the sound roared into view. A half-dozen fiberglass speedboats propelled by outboard motors skimmed past the *Unicorn* and rushed to intercept the galleon. Each bore four or five pirates armed with M-16 rifles and .45 automatics, and all of them greeted the crew of the *Unicorn* with rude laughter and haughty gestures.

"Oboy," Kirby said with a sigh. "Turnbuckle's obviously been smuggling more than just weapons."

Sally Boots and the others of her crew were too stunned by the sight to say anything at the moment. As they watched with mouths agape, the speedboats quickly left the *Unicorn* behind and closed with the Spanish vessel.

It was now apparent that the galleon was armed with a few cannon at least, for their brass mouths poked out through the vessel's gun ports. But the ship's would-be defenders were having the very devil of a time finding a target for their unwieldy weapons. The speedboats were dodging and whizzing about like flies pestering a very stout cow, and by the time the Spanish gunner's mates did loose a volley in exasperation, the cannonballs fell in empty water a good deal closer to the *Unicorn* than any of the attacking craft. A fact which encouraged the *Unicorn*'s crew to lower sail and hold back.

The chatter of automatic weapon fire sent the crew of the Spanish vessel running for cover and, as if the battle hadn't already been one-sided enough, one of Turnbuckle's men suddenly launched a bazooka round into the galleon's aristocratic figurehead, blowing it to smithereens. After that came the tear gas canisters.

Small white flags began popping up like spring flowers in a time-lapse nature film. Some of them were made of kerchiefs and some of them were torn from tattered shirts. *All* of them were waving frantically.

Aboard the *Unicorn*, everyone was gathered at the bow, watching as Turnbuckle's men now boarded and took over the Spanish vessel with ease. Too much ease to suit Sally Boots.

"What kind of battle do you call that?" said she. "Where's the challenge? *Any* fool can be a pirate that way! And the Spanish didn't even put up a good fight."

"*Quite wisely, I assure you,*" boomed a voice behind them. "And I trust you'll display equal wisdom—?"

To a man, the crew of the *Unicorn* spun around. For there at the ship's stern were five men, with a sixth and seventh still climbing aboard from a powered longboat tied up at the rail. All but one of them held automatic weapons trained on the crew. And the one that did not stood there bearing the prideful grin of an overgrown Boy Scout eminently pleased with what he had accomplished.

"How dare you board this ship!" said Sally Boots.

"Well, bless my bones," Roger Turnbuckle observed gleefully. "A pirate of the fairer sex."

Awakening from their initial surprise, the crew of the *Unicorn* began to advance upon the men they well outnumbered. They thought better of this in the next instant, however, as one of Turn-

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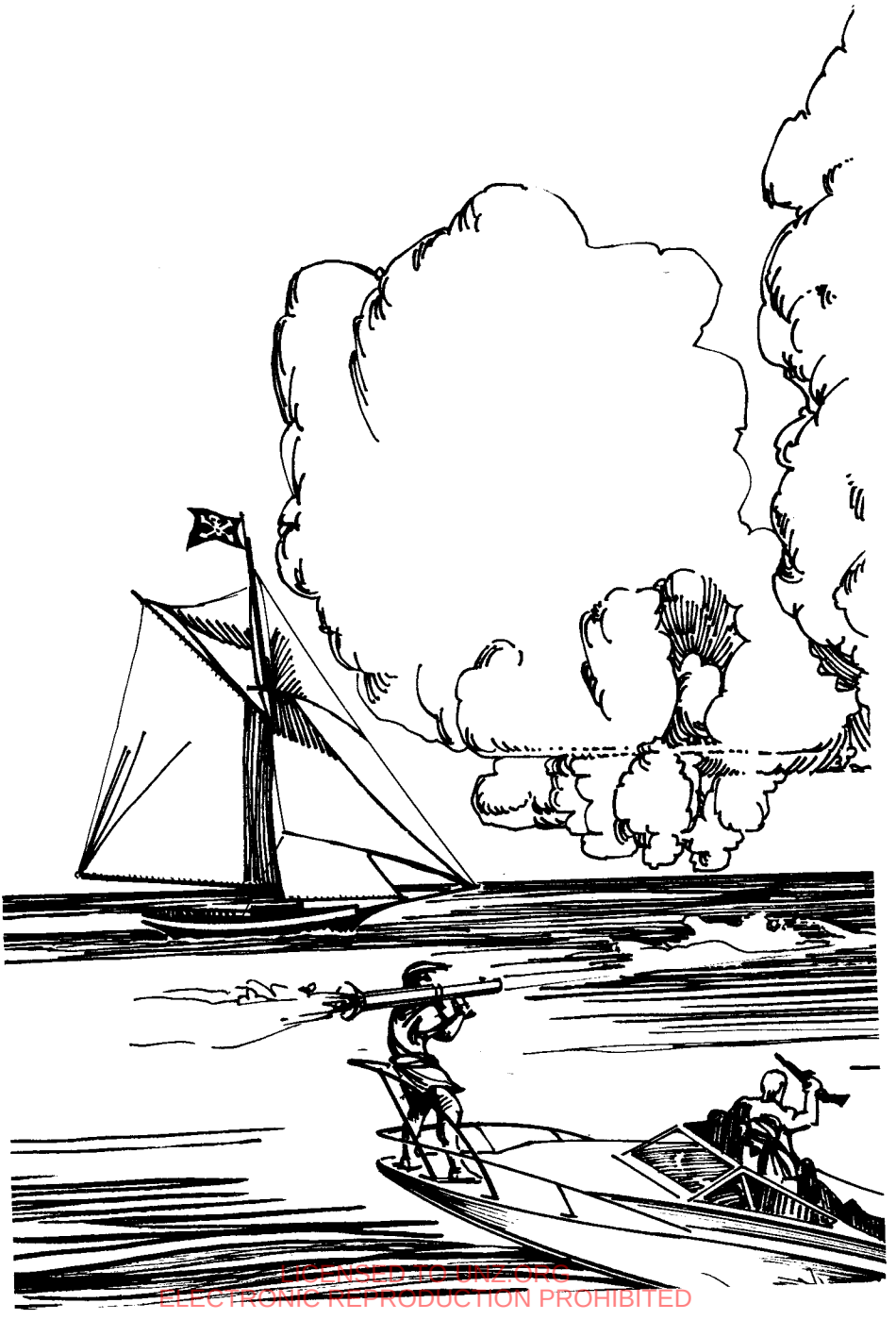

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buckle's men fired a warning burst of rounds into the deck before them, turning the planking into wormwood.

"Now be good sports and lay down your weapons," Turnbuckle scolded good-naturedly. "There's no need for bloodshed . . . not yet, anyway. We didn't plan on entertaining guests, but I'm sure we can find *something* to keep you occupied. . . ."

"This is a marvelous mess," Zane Kirby said glumly, his hands and feet shackled.

"A shame and disgrace," agreed Tom Oakes, likewise bound.

"*Mmmmph!*" added Sally Boots, who had been gagged as well as bound when even the calloused ears of Turnbuckle's pirates could take no more of her vile imprecations and withering insults.

They were seated not too comfortably on the sandy ground of a lesser island in the Bahamas chain not far from the northern trade route. Night had fallen, and torches illuminated the desolate stretch of beach where Turnbuckle's crewmembers relaxed and refreshed themselves with rum liberated from the galleon's stores. Surprisingly, little more than the rum and some foodstuffs had been taken from the Spanish vessel, which had been set free and allowed to continue on its way. Zane Kirby wondered about that, almost as much as he wondered how he might get to the big sea chest which held his laser/stun gun along with the other captured weapons.

Roger Turnbuckle approached them with a bit of a swagger, all decked out in his best pirate finery and obviously relishing the situation. He stopped before the group of bound crewmembers, put his hands on his hips, and smiled charmingly.

"My, but I *do* love a captive audience," he said. This brought a chorus of rude comments and grumblings from the crew and a positively venomous croak from Sally Boots. Turnbuckle dismissed them with a wave of his hand. "Now, now—let's not be negative! I'm about to offer you an opportunity to be rich. *Really* rich."

"We're listening," Tom Oakes grumbled, "seeing as how there's little else we can do at the moment!"

Turnbuckle began to pace a bit, explaining as he went. "It's really quite simple. What you witnessed today was of course merely a practice run. A chance to test out our technique."

"Some technique!" Tom Oakes chortled. "You let the ruddy ship go!"

"A worthless trifle," said Turnbuckle with a flourish of his hand. "It pales to insignificance beside the prize that will be sailing our way in less than a week. I'm speaking of nothing less than the Spanish Plate Fleet."

There were several low whistles of appreciation and a murmur or two of disbelief. Turnbuckle nodded smugly, knowing he had their full attention now.

"Yes, the Plate Fleet. Heavy laden with gold and silver from Central America, Mexico, and the Philippines."

"Aye," said Tom Oakes, "and heavy *guarded* it be, as well. A man would have to be daft to challenge those ships."

"A man with ordinary weapons, yes. But with the weapons you've seen today, it would be child's play. I can do it with the men I have, if need be, but

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it would be even easier if you would join us. Under *my* leadership, of course."

"Mmmm-mmmm-*mmmph!*" said Sally Boots vehemently, and though her words were muted, her look was fiery enough to melt metal.

Tom Oakes, possessing an older and cooler head, translated for her. "She says she'd like to think it over."

This brought a withering look from Sally, but Turnbuckle seemed to take it on face value. "Very well. You may all have until tomorrow morning to reach a decision. Those that wish to join me will leave with us. Those that do not—" he smiled— "well, let's just say they'll be enjoying the somewhat limited attractions of this little island for an indefinite period of time. And now, I must bid you all a good night."

As Turnbuckle strode off chuckling to himself, Gus flew down from the palm tree where he had been observing things and landed on Kirby's shoulder. "Hi, Zane. Having fun?"

"Loads. Can't you tell?"

"Do you really think Turnbuckle will let us join him?"

"Sure," said Kirby. "Until he gets his hands on the treasure. After that, I doubt if he'll even share it with his *own* men. Anyway, he'll never persuade Sally. I'm sure she'd rather be marooned here than take orders from Jolly Roger."

"True. Which means we'd better make our move tonight." Gus motioned toward the shackles on Kirby's wrists and ankles. "I suppose you want me to help you get out of those?"

"It *would* help. Can you pick the lock?"

"If I had hands I could. Will you settle for the key?"

"Have you got it?" said Kirby.

"I will have." Gus took off. "Don't go away—"

"Wise guy," Kirby said, then became aware that Tom Oakes was staring at him. There was enough distance between them that Kirby doubted the old pirate could have made out their words, but conversing with a parrot was hard to overlook. He flashed the grizzled salt an embarrassed smile.

Tom Oakes studied him a moment before shrugging. "Don't worry, lad," he said at last. "I know better than most how lonely a sailor's life can be."

The key to the shackles was in plain sight, which simplified things. But it was hanging at the opening of the improvised pup tent Turnbuckle had set up to shelter himself for the night, and *that* complicated things. Gus perched for a moment upon a scruffy bush growing near the front of the tent and surveyed the situation. The majority of Turnbuckle's crew seemed to be boozing it up too much to pay any attention to one lone parrot. And Turnbuckle himself was already drifting off to sleep.

In fact, as Gus watched, the slightly portly time-smuggler rolled over on his side and began to snore. He instantly rolled back a bit and one hand fished sleepily in the big pocket of his long coat. The hand then withdrew a pocket-sized time machine and laid it nearby, where it wouldn't prove such an unpleasant lump.

"Sheffield was right," Gus said to himself. "It *is* a Japanese model."

Summoning up his courage, Gus flew over to the tent and landed on the long

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cross-piece at the top. All he had to do now was reach down and take hold of the leather thong upon which the key dangled. He had just about got his beak around it when he became aware of someone approaching.

"Hey—" said the husky pirate, and Gus froze.

The man, wearing both a flintlock and an automatic, walked right up to him. Actually, staggered might be a better word, for he reeked of drink and looked a bit unsteady on his feet. Perched atop his shoulder was a white cockatoo busily chewing on something, and as he stopped before the tent the pirate held up a soggy biscuit in inebriated generosity.

"Polly wanna cracker—? Polly wanna—*hic*—cracker—?"

Gus's initial fear of discovery gave way to irritation. He told the pirate, "Eat it yourself, Rum-Dum!"

Gus looked at the cockatoo. The cockatoo looked back and winked. He couldn't be sure, but with what residual instinct still reposed in his parrot's noggin, he had a nagging feeling that the cockatoo was a female. The she-bird winked again, then turned her head coyly. Now he was sure.

"The Bureau doesn't pay me enough," Gus muttered, "to put up with all this."

He had just shifted his gaze back to the pirate's unlovely features when he suddenly found himself looking into the mouth of the man's flintlock pistol. The .60-caliber iron-barrelled piece looked like a cannon, and it was so close to his beak he could smell the powder.

"Well, since you put it that way," Gus said, his voice echoing down the bore, "Polly would just *love* to have a cracker."

The pirate lowered the pistol slowly and smiled, then extended the soggy biscuit once more. Gus forced himself to take a bite.

"Yum, yum," he said, far from truthfully. "And it's so kind of you to think of me, while your friends are drinking all your rum."

The pirate nodded agreeably, then frowned as the words sank in. He turned toward the beach. "All . . . my rum—?"

"Yes. Generous of you."

The pirate muttered something dark and murderous and staggered back toward the group of revelers. But although one problem was removed, another remained. The cockatoo left the pirate's shoulder and flew back to land upon the tent next to Gus. Ignoring her, Gus bent down to peer cautiously into the tent. Fortunately, Turnbuckle had not awakened during the conversation. Gus quickly grabbed the leather thong in his beak and lifted the key from where it hung.

"Hello—?" cooed the cockatoo.

"Buzz off, honey. You're not my type, and I've got work to do." And with that Gus took off and headed back to where Zane Kirby and the others waited.

"What took you so long?"

Gus landed on the ground in front of Kirby. "I had a few distractions." He took the key in his beak and inserted it into the lock on the shackles binding Kirby's wrists. He waited a moment before realizing his partner's hands still could not reach the key, then gave it a twist himself.

"There you go," Gus told him.

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"What are your plans now?"

Kirby worked on freeing his ankles. "First, I want to get to that sea chest and reclaim my pistol. Are there many guards about?"

"One or two. But I don't think they're really expecting trouble." Gus scratched his head with his right foot. "While you're at it, you might be able to pick up Turnbuckle's time machine. It's lying on the ground in his tent. So is he, for that matter, so exercise caution."

"Thanks for the tip. When things start happening, I don't want him popping off to some other century." Kirby had kept his voice low, and he looked now to see if the others were aware of what was happening. Tom Oakes was dozing already, as were many of the other captured pirates. Sally Boots was swiveled away from him, apparently enjoying a good pout. "Okay, Gus," Kirby said, "here's what I want you to do. While I'm getting my pistol and gathering up as many of the automatic weapons as I can find, you can free Sally. She can free the others and get them organized. But keep them quiet until we're ready to make our move."

"Just because I'm a freeping bird doesn't mean you can order me around—"

"*Gus*—"

"All right, all right. It's a good plan, anyway. Although explaining all this to Sally is going to take *some* doing."

"I've complete faith in you," Kirby told him.

"Sure, sure," Gus replied.

"*Hello—?*" said a sultry voice.

Kirby watched as the cockatoo came sauntering toward Gus. "Who's your friend?"

Gus groaned. "Don't ask. But do me a favor and take her with you."

"What? And spoil a budding romance?" Kirby quietly got to his feet and started off. "Good luck with Sally."

Gus watched him disappear into the darkness and seriously considered the possibility of requesting a transfer to a nice, quiet desk job. Then he sighed in resignation and flapped over to where Sally Boots sat in gloomy contemplation.

She jumped a bit as Gus landed before her, then gave him an irritated frown. But her expression changed to one of amazement as Gus proceeded to unlock the shackles on her fancy boots, then hopped up to her knee to work on the manacles holding her wrists.

"Okay, Sweets," said Gus. "Listen up and listen good."

Sally's eyes widened. "Mmmph?"

"We're not supposed to reveal who we really are," Gus continued, "but sometimes you have to bend the rules a little. I don't usually look like this, you understand. I'm a lot taller, kind of ruggedly handsome, and my voice is deeper."

Sally was out of her shackles now and quickly removed her gag. She stared dumfounded at the talking parrot. "*But who—? But how—? But why—?*"

"Look," said Gus hotly, "I haven't time for a lot of half-asked questions! Zane's got a plan and we've got to help him. You don't want Turnbuckle to revolutionize piracy like you saw today, now do you?"

"Well, no," she said, a bit of a pout returning. "It would take all the fun out of hand-to-hand combat."

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"Exactly. Now let's get your friends set free. But maybe you'd better handle it. I don't want to have to explain this to all of them."

The cockatoo, still in pursuit, gazed wistfully up at Gus and Sally. *"Hello—?"*

Sally fixed it with a wary stare. "And who," she said cautiously, "are you—?"

Zane Kirby crept stealthily toward the big sea chest wherein reposed the collected weapons of Sally's crew, his own included. Gus had been right—there were few guards about, and most of Turnbuckle's men were settling down into boozy sleep. He had to rummage about in the chest a bit to find his own weapon, but it seemed to be in perfect condition when he pulled it forth.

"Hey, Mate—" boomed a menacing voice very near him. "Those ain't to be divvied up 'til in the morning." The voice belonged to a muscular pirate who apparently held his liquor a lot better than his compatriots. And his look of challenge became even more intense as he studied Kirby's features. "Hey—ain't you one of them what was—"

There was a brief, high-pitched note and the pirate suddenly froze where he stood, finger still pointing accusingly, mouth still open to form a word. Zane Kirby straightened up and smiled, patting his "flintlock."

"Yep. Stunner still works fine." He looked about and spotted another lone guard standing watch beneath a palm tree on the shore. Feeling reckless, he changed the control on his flintlock, aimed high, and fired again.

A nearly invisible beam hit the top of the palm and sent a cascade of coconuts dropping. One struck the sentry squarely on the noggin and two more struck glancing blows before the man had time to fall, out like a light.

"Laser works, too," Kirby observed. He collected the first guard's automatic weapon and headed for Turnbuckle's tent. He could hear the wayward time-traveler snoring even before he peeked into the tent opening. Quietly and with exquisite care, Kirby reached inside and picked up Turnbuckle's time machine. Easing back out, he pocketed the device and moved away from the area.

He proceeded to collect the automatic weapons from the sleeping pirates with relative ease, and in a matter of minutes had gathered them all up. The problem was, what to do with them? He couldn't let them fall into the hands of Sally Boots and her friends either. Then a thought struck him as he gazed out to where Turnbuckle's ship was anchored. The motorboats were still aboard the vessel, as were many of the other out-of-time weapons. It would be nice if all the contraband gear was in one place. Kirby eyed the beach, where waited several longboats and a pinnace. . . .

"It must be a fever," Sally Boots muttered. "Father used to think he could hear the teacups talking."

Perched on her shoulder, Gus shook his head in exasperation. "You haven't got a fever, and there's nothing wrong with your mind, apart from an unnatural tendency to commit mayhem."

"Maybe," she said with a scowl. "But when's Zane coming back? Everyone's been freed and I'm getting tired of waiting."

"You're getting tired?" Gus said.

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"You ought to try this stuck in a bird suit."

Tom Oakes approached Sally with a cautioning gesture. "Someone's coming—maybe it be one of Turnbuckle's men."

They all crouched low, taking what cover they could find, as faint footsteps grew nearer. In what cloud-filtered moonlight there was, they could make out someone, hunched over and pulling a large sea chest through the sand. The figure halted just short of reaching them.

"Gus—?" said a voice that was hushed and wary. "Sally—?"

"Well—it's about time," said Sally Boots, as she straightened up and approached Zane Kirby. "And what king put you in charge, anyway?"

"You're still in charge," Kirby told her. "All I want is to get Turnbuckle and those guns of his back where they belong. And don't forget, I got you loose."

" 'Twas your jabbering parrot that unlocked me." Her eyes fixed on the sea chest Kirby brought them. "Is my hardware in there?"

"Yes. And the others', too."

The gear was quickly handed out, and as Sally hung the cutlass at her side and tucked both pistols into her sash, she said, "There—*now* I feel proper dressed. But what of Turnbuckle's men?"

"Sleeping off their rum. I don't think they'll be any problem." To Gus, Kirby added, "I rowed out to his ship with all the automatic weapons, so once we take Turnbuckle there we'll have everything in a nice, neat package to take home. This is almost turning out to be *too* easy—"

"Don't say that!" Gus ruffled his feathers. "Every time you say that, Zane, something goes—"

BANG!

"—wrong. . . ."

Kirby glanced at his flintlock, remembering the guard. "Maybe I should have set this for heavy-duty stun."

"You may be sure that shot woke everyone," said Sally Boots, grabbing her cutlass with one hand and a pistol with the other, "and drunk or sober, Turnbuckle's men will still be ready for a fight. Well—let's give 'em one!"

"You're a sweet kid," Gus said as he flew from her shoulder. "But sticking with you could be hazardous for my health!"

What ensued was more of a free-for-all than a pitched battle. Cutlasses clashed, fists flailed, and sailors' curses filled the air. In fact, it was fast becoming such a marvelous brawl that it was beginning to be hard to tell one side from the other.

Zane Kirby dodged one pair of combatants who were trading punches with almost gleeful relish, spotted Turnbuckle trying to crawl backwards out of his narrow tent, and gave his ample posterior a resounding *whack* with the flat of his cutlass. He ducked an empty rum bottle that had missed its intended target and turned just in time to see one of Turnbuckle's men, well-pickled to the point of looking cross-eyed, raise his flintlock in both hands and take point-blank aim at Sally Boots, who had already subdued three pirates and was looking for the next.

There was little time to act and scarcely any to think. Kirby sprang from where he stood and threw himself at the

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girl, knocking her out of the line of fire. The flintlock's *crack* rang loud in their ears as they fell to the ground, and the one-ounce pistol ball whizzed overhead to bury itself in a palm's weathered trunk.

Regaining her breath, Sally Boots looked up into Kirby's face and said peevishly, "Making a regular habit of this, aren't you?"

"Sorry again," said Kirby. "But would you rather have been shot?"

"You're tempting fate with that question!"

Kirby scrambled to his feet and helped her up just as two more opposing pirates struggled past in a kind of wrestler's waltz. Searching his belt quickly, Kirby said, "Where's my flintlock?"

"If it's not still stuck in my ribs, then I've no idea." Sally looked about on the ground. "Wait—is this it?"

Kirby took the weapon she'd picked up. As he turned it in his hands, it rattled. He pointed it skyward and pulled the trigger. Nothing happened except an apologetic click. "Rats—the fall must have jiggled its insides loose!"

"Mine too, I fear," said Sally, dusting herself off and picking up her cutlass. "But I'm in a mood for finding that rascal Turnbuckle. Have you seen him?"

"Over there—" Kirby told her, pointing. But the tent was empty. Turnbuckle had disappeared in the commotion. "Now where's he gone—?"

"The beach! The beach!" said a voice from above. It was Gus, flapping overhead. "He's making a run for the ship!"

Kirby looked. Gus was right. Turnbuckle and four of his men were racing for a longboat that would take them out to the big sloop. The sloop and all the fancy weapons.

"If they reach their hardware," Kirby warned, "we've got no chance of capturing them. C'mon!"

They too raced for the beach, and by the time they reached the spot, Turnbuckle and his men were already rowing out past the surf. There was a longboat and a pinnace left, and Kirby chose the smaller vessel, pushing it well out into the water. He boarded after Sally Boots and starting rowing.

Gus sailed down and landed on Kirby's shoulder. "Row faster, Zane! They're getting away!"

Kirby puffed as he pulled on the oars. "If you think you could do better, you're welcome to try!"

Minutes passed, and Sally Boots said, "They're still ahead of us. I fear they *will* reach the ship before us."

"She's right," said Gus. "It looks like we're running out of time."

"Time? Now there's a thought!" Kirby abruptly stopped rowing.

"Have you gone daft?" said Sally. "Keep rowing!"

"Wouldn't help," said Kirby, pulling from his pocket the time machine he had taken from Turnbuckle's tent. "They'd still reach the ship first. But if I use this there won't be any ship to reach."

"It'll never work, Zane," protested Gus. "That little unit might be able to send some of the guns and other gear back to our time, but it'll never handle the whole ship!"

"It might if I overload the circuits." Kirby was tinkering with the back of the device, shorting out the controls so that

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the power cells would discharge all their energy in one enormous spurt. "At any rate, it's worth a try. But I'll need a delivery system. Think you can fly it over, Gus?"

"I had a nasty feeling you were going to say that. All right—I'll give it my best shot."

Kirby held up the device and let Gus grip it in his feet. "I've set it for delayed activation, so you've got thirty seconds to get it there and fly out of the immediate vicinity. Okay—*go!*"

Gus started flapping and groaned a bit as he realized the full weight of the pocket time machine. He was putting everything he had into it, but the longer he flew, the lower he got to the water. He was nearly skimming the waves as he passed Turnbuckle's longboat and approached the sloop.

"Go, Gus, go!" shouted Kirby.

Sally Boots pouted at the bow of the pinnace. "I *still* don't know what the devil you're doing!"

Turnbuckle was beginning to jump up and down in the longboat as he recognized what the parrot was carrying. He shouted orders for his men to hurry and reach the ship. He shouted orders at Gus. He did a *lot* of shouting all around.

But Gus heard none of it. He was tuning it out to make room in his head for something more important ". . . 19 . . . 20 . . . 21 . . . 22 . . ."

With one last surge of energy, Gus flew up high enough to clear the gunwale and dropped Turnbuckle's time machine in the center of the deck. Then he did a tight Immelmann away from the sloop and headed back for the pinnace with as much speed as he could muster.

"I think he's started back." Kirby peered ahead. "But it's hard to see in the dark—"

Suddenly, things weren't as dark as they had been! The entire ship seemed to glow with abruptly released energy, as a banshee wail assaulted their ears. The ship began to sparkle as if each atom was celebrating the Fourth of July, then the banshee wail abruptly faded out with a final *VEEOOOP!* And so did the ship. In the next instant it was gone.

This was simply too much for Turnbuckle's men. All four jumped overboard and began to swim back to shore. Turnbuckle himself sat down in the longboat, cradled his head in his hands, and sighed deeply.

In the pinnace there were sighs of a different nature. For Gus now came into view, flapping wearily back and relieving the fears of Zane Kirby and Sally Boots.

As he landed on the side of the boat, Kirby said, "Gus—you made it!"

"Just barely," Gus told him, panting a bit from exertion. "Good thing, too . . . don't know where that ship went . . . but I bet it wasn't back to our time . . . not with *those* fireworks!"

At that moment, another sound of fluttering wings caught their attention, and a large white bird landed next to Gus on the side of the pinnace. She nuzzled against his wing.

"*Hello—?*" she cooed, with a wink.

"Get me out of here, Zane!" screamed Gus. "I think I'm actually beginning to be attracted to this cockeyed cockatoo!"

Back on shore, the two trans-temporal agents had everything pretty well

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wrapped up. Turnbuckle was in shackles and ready for transport, his men were rounded up and eager to make peace with their fellow pirates, and Sally's crew were finally enjoying what remained of the food and rum looted from the Spanish galleon.

As for Sally Boots, she watched with growing amazement as Kirby produced his temporal communicator from the heel of his boot and proceeded to fill in Commissioner Sheffield on everything that had happened. Especially when Sheffield's round face appeared on the device's tiny view screen.

"All right," Sheffield was saying. "We'll see if we can locate the ship with our scanners, and, ah—" He hesitated as he became aware through the two-way viewer of Sally Boots staring curiously at him over Zane's shoulder. "Ah—Agent Kirby, haven't I cautioned you against using Bureau equipment in front of unauthorized persons?"

"Who? Oh—her," said Kirby. "Sorry, Commissioner, but I'm sure we can trust her to keep our secret. After all, I even saved her life—"

Kirby knew as soon as he said it that it was a mistake. Sheffield's features clouded instantly.

"Oh dear, oh dear," scolded the Commissioner. "You know as well as I, Agent Kirby, that Bureau regulations specifically state that no agent may so act as to either cause *or prevent* the death of a temporal native. Can't have history all mucked up, now can we? This has never happened before—it's quite unprecedented. Well, I'll leave the problem in your hands to correct. Ending transmission—"

"But I . . . *Commissioner—?*" Kirby saw the screen go blank and knew it was useless to argue. If Sheffield didn't want to discuss some particular unpleasantness, he simply wouldn't respond. Kirby put the communicator away and turned to Sally.

Her dark eyes glistened in the torchlight, looking puzzled and more than a little worried. "What exactly did he mean by all that?"

"I'm afraid he's right," Kirby told her. "I did break the rules when I saved your life. By all rights, you shouldn't be here now. So . . . I guess there's only one thing I can do. . . ."

Back in their own century, Zane Kirby waited outside the mind-transference chamber at FBTR HQ and peered through the observation window. Gus McAbee's parrot form waited impatiently at one end of the complex equipment, and the bird's human form waited with equal impatience at the other, now garbed in a robe and various restraints.

"Is that poor fellow out of his mind?" asked Sally Boots as she stood next to Kirby's side. "First he flapped his arms about as if trying to fly, and then he actually *snapped* at those other people in there!"

"It's more the other way around," Kirby explained. *"His mind's out of him.* You see, it's a little hard to explain, but that parrot you've been chatting with is really him, and vice versa. It's just that their minds have been *well*, traded for a while."

"Indeed?" She looked at Kirby with a dubious frown, but watched in silence as the transference was completed.

Minutes later, Gus—the *human* Gus this time—came out of the chamber and

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approached them, flexing his muscles. "*Man*, it feels good to be back in my own ever-lovin' skin! Even if I do have leg cramps from that freeping perch."

Sally Boots studied him for a moment, then looked again through the window at the parrot, who was now acting exactly as a parrot should. Shaking her head bewilderedly, she said, " 'Tis the devil's own magic!"

"No, no," said Kirby. "Not magic, Sally . . . *science*."

"Oh, I don't know," Gus told him with a wicked grin at the girl. "At the moment I'm feeling a lot more devilish than scientific."

"Ahem!" cautioned Commissioner Sheffield as he came down the hall toward them. "Agents Kirby and McAbee—glad to see you made it back safely. And this, I presume—" he added, consulting his report "—is Miss *Boots?* Or is it Higgins?"

"*Higgins* will do nicely," Sally told him.

"I know it's a bit irregular, sir," Kirby said. "But since she technically could no longer continue to exist in her own time, the only acceptable alternative was to bring her back with us to our time."

"It's *highly* irregular," Sheffield corrected with a stern look that quickly melted. "But under the circumstances, I could hardly disapprove."

"What about Turnbuckle's ship," Gus suddenly interjected. "Have you located it yet?"

"Yes . . . and no," Sheffield said with a frown. "*Yes*, in the sense that we know where it is, and *no*, in the sense that we cannot put our hands on it or its cargo."

"Can't put our hands on it?" said Kirby. "What do you mean?"

Sheffield knitted his fingers over his expansive chest. "Well, apparently when you tampered with the controls of Turnbuckle's time machine, it overloaded to such a horrific extent that it could no longer accurately target upon a specific date to send everything to. To put it simply, the resulting energy flare caused a temporal explosion that sent the ship out over a wide range of time periods all at once. It's still there, in the past, present, *and* future. But it's spread so thin that in any given moment there's not enough present to amount to anything."

"Or to put it even more simply," observed Gus with a nasty chuckle, "we blew it sixteen ways to Sunday with an ever-lovin' *time bomb!*" ■

● In ecology, as in economics, TANSTAAFL (There Ain't No Such Thing As A Free Lunch) is intended to warn that every gain is won at some cost. Failure to recognize the "no free lunch" law causes the buffalo-hunter mentality syndrome—the unthinking assumption that there will always be plenty because there always has been plenty.

Dr. Robert W. Prehoda

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a calendar of analog upcoming events

4-7 September
GLASC VI (Greater Los Angeles Simulation Convention) at the Student Union, California State University, Northridge, Calif. Gaming conference—seminars, dealers, auctions, etc. Registration—$6 in advance, $8 at the door. Info: GLASC Secretary, % L. Daniel, 20550 Wyandotte St., Canoga Park CA 91306.

11-14 September
UNICON 2 at Keele University, U.K. Guest of Honour—John Sladek, Fan Guest of Honour—Alan Dorey. Registration £3 supporting, £5.50 attending. Info: "Bridge End," Shawbury, Shrewsbury, Salop., U.K.

16-18 September
Oceans '81 at Sheraton Boston Hotel, Boston, Mass. Oceanographic Conference. Info: Oceans '81, P.O. Box 132, Portsmouth, RI 02871.

18-20 September
EARTHCON at Holiday Inn Downtown, Cleveland, Ohio. Registration $22 ($10 daily at the door). Banquet $20. Info: C.P. Gloger, 23920 Fairmount Ave., Shaker Heights OH 44122.

18-20 September
OTHERCON V at Ramada Inn, College Station, Texas. Guest of Honor—Gordon Dickson. Registration—$8 until 1 September, $10 thereafter. Info: OtherCon V, 203 Edge Street, Bryan TX 77801. (713) 775-0692 or 779-2588.

25-27 September
MOSCON III at Moscow, Idaho. Guests of Honor—Kate Wilhelm and Tim Kirk; Fan Guest of Honor—Suzle Tompkins; Special Guest of Honor—Damon Knight.

25-27 September
URCON III at University of Rochester, Rochester, N.Y. Info: URCON III (SF), University of Rochester, P.O. Box 6647, Rochester NY 14627.

2-6 September 1982
CHICON IV (40th World Science Fiction Convention) at Hyatt Regency Chicago Hotel, Chicago, Ill. Guest of Honor—A. Bertram Chandler; Artist Guest of Honor—Frank Kelly Freas; Fan Guest of Honor—Lee Hoffman. Registration—$15 supporting at all times. Attending—$30 until 30 June 1981, higher thereafter. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Chicon IV, Box A3120, Chicago IL 60690.

—ANTHONY LEWIS

Items for the Calendar should be sent to the Editorial Offices ***five months*** *in advance of the issue in which you want the item to appear.*

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the reference library

By Tom Easton

The Book of Dreams, J. Vance, DAW, $2.25, 235 p.
Jack Vance, T. Underwood and C. Miller, eds., Taplinger, $12.95, 253 pp.
Shatterday, H. Ellison, Houghton Mifflin, $12.95, 332 pp.
Under the City of the Angels, J.E. Brown, Bantam, $1.95, 256 pp.
Downbelow Station, C.J. Cherryh, DAW, $2.75, 432 pp.
A Fond Farewell to Dying, Syd Logsdon, Timescape (Pocket), $2.25, 167 pp.
Time's Fool, G. Carrington, Doubleday, $9.95, 180 pp.
Science Fiction Studies in Film, F. Pohl and F. Pohl IV, Ace, $6.95, 346 pp.
DiFate's Catalog of Science Fiction Hardware, V. DiFate and Ian Summers, Workman, $8.95, 160 pp.
The Ragged Edge of Science, L. Sprague de Camp, Owlswick, $16.00, 244 pp.
New Worlds for Old, D. Lunan, Morrow, $12.95, 268 pp.

At some point last year, the mailman brought me a raft of books by Jack Vance. I read them and used them to start off one of these columns, saying that 1980 seemed to be "The year of Jack Vance."

I was wrong. It may be more nearly right to point to a decade for the man. I just received another raft of his books, along with a "Writers of the 21st Century Series" critical volume. Most of the books are reissues, and I may never get around to them, not if I keep getting new stuff that seems worth looking at. One is the fifth and final volume in the Demon Princes series: **The Book of Dreams**.

As a child, Kirth Gersen, hero, took on a burden of hate and vengeance when five arch-criminals, the Demon Princes, raided his world for slaves, killing those who resisted and carrying off all the rest except for Gersen and his grandfather. In each book of the series he has tracked down and dispatched one of the five.

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The fifth and final villain is Howard Alan Treesong. He is chief of all thieves, so ambitious that he tries to take over the Interworld Police and nearly succeeds, so elusive that no one knows where to find him or what he looks like. Yet Gersen finds, by luck, a photo of a group that must include the man. He uses it as the puzzle for an all-worlds magazine contest—"Name these people and WIN . . ."—and garners clues that lead him to a home-world class reunion. There Treesong revenges himself for long-ago slights in ways that must appeal to all traditional SF fans—proverbially acned outcasts in youth—and escapes Gersen, though wounded. The end comes when Gersen contrives to put Treesong in the hands of a past victim, a taxidermist of sorts.

The book offers Vance's typical social intricacy and nomenclatural ingenuity; the plot is as sturdy as only a mystery writer (Vance is one of those, too) can provide; scenes are painted with Vancian lushness; and the characters are interesting, if reminiscent of cartoons at times. The ending is striking in a way, for Gersen, having achieved his final goal, is left with nothing but ennui, anomie, restlessness. It's a convincing touch, one that often marks Vance's endings (see below), but stands out particularly here. Perhaps in no other story is it so well justified, so much part and parcel of character and situation.

Arthur Jean Cox calls the Demon Princes series Vance's best work in SF in **Jack Vance** (the critical volume I mentioned), saying of these books and other tales of the same period that "Their distances seem to be filled . . . with golden light" (p. 76). Certainly the plots are more rigorous, more thoroughly worked out—though perhaps not less arbitrary, less dependent on fortune. What do others say about the man and his works? Listen to the contributors to *Jack Vance*:

Norman Spinrad: "In our modern Bauhaus age where form is supposed to follow function, Jack Vance is a man who makes style generate content. . . . His worlds have an existential and moral reality, and are informed by a mordant dubiousness about man and his works."

Peter Close: "The ending has now become standard for Vance: the two protagonists, their preoccupations resolved, now find their future directions open and experience a disconcerting sense of aimlessness" (*re* "Guyal of Sfere").

Arthur Jean Cox: "Those qualities associated with Vance—intelligence, tact, inventiveness, strong syntax and narrative, a style at once vivid and cool."

Don Herron: "Vance's abiding concern is with . . . local situations. His is the art of xenography—the art of devising and exploring exotic and alien societies in a very distant future period when humankind has spread far from our own planetary system."

And more. The book claims that Vance has been neglected by the critics, and tries to fill the gap. It discusses his growth from his early horrors to his later flowering and his development of a distinctively sensual style. However, it lays far too little emphasis on what I think is Vance's real contribution to the field: the completeness of his visualizations of societies, of group behavior. It stresses far more his ironic cynicism and his lush descriptions that would, if they issued from any other pen, be dubbed "purple." Purple they are, too, for they strike me as exceeding the bounds of the necessary, and thereby lose effectiveness. The typical Vance description reads rather more like that

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of a man who cannot or does not use deftness; he is perhaps a man who prefers the palette knife to the dry brush, a conductor who prefers massed violins to a solo flute.

Perhaps an example drawn from *The Book of Dreams* (p. 191) will convince: "The forest foliage was only predominantly blue, in three hues: ultramarine, bright sky blue, and pallid chalk blue. Additionally, certain trees showed foliage of beetle-wing green and a few were gray. Enormous soft-winged moths moving through the sunlight created a teasing flicker of crimson and black. . . ." It is skillfully done, yes, but its appeal is definitely a matter of taste. I prefer a leaner prose myself.

Jack Vance's purpose is to discuss Vance. It does so, of course, and its eight essays add up to a seemingly complete sketch of the man and his work. Yet the book's most valuable contribution may be in what it says about SF as a genre, as a whole. Why is Vance considered so great? Because, apparently, most SF writers sacrifice sensual awareness of place and person to events and ideas. Perhaps this is as it should be, for we often define SF as a literature of ideas, not senses. But Vance does supply a missing element, a trace element as necessary to literary vitality as vanadium is to our own. His role in the field may be to impel others to add that element, though with more restraint, with less risk of overdosing the reader.

I'll let you name your own examples. If I gave you mine, I might only start an unnecessary argument.

Harlan Ellison is clearly the real-life Demon Prince of SF. Clever, ingenious, venomous, vigorous, he is a model of the literary guerrilla fighter. He takes tours in other people's lives, digests what he finds, and returns it transmogrified in ways that grip even the sources, despite pain and tears and laughter. If he strikes a chord in *your* soul, he will make you scream, but he will also compel you to read on. You will hate him as an intrusive, shambling beast, but you will love him too. He tells all, and well, and profitably, and the moral of his tales is often "You are not alone."

All this is true of his latest collection, **Shatterday**. He tells you so himself in his introduction and in the headnotes for his stories. I won't try to prove it. It is enough to mention "Jeffty is Five," "All the Lies That Are My Life," and "All the Birds Come Home to Roost": potent tales, gruesome tales, human tales. There are lighter ones, too, as in the cynically hilarious "How's the Night Life on Cissalda?" in which the perfect f**k invades Earth (Oh! What Harlan does to Anita Bryant!).

Enough. You surely know Ellison. You surely know whether you want another book full of his stuff. But just in case you've missed him, I'll say it: Try him on. You may feel violated, raped, invaded, tormented, but you *won't* feel cheated.

Jerry Earl Brown is a writer worth watching. **Under the City of the Angels** is a good first novel. It begins as a paranoid alien civilization dispatches an expendable servant to Earth, mission undefined to the reader. It begins as looter Mad Jack Kelso searches the ruins of Los Angeles beneath the Pacific waves; the city sunk by a massive earthquake apparently triggered when nuclear explosives being used to search for oil upset some delicate balance. Rumors are referred to. Watchers and vindictive hunters are introduced. A woman appears to enlist Kelso in her own search for a forgotten past. An alien revolution begins.

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All these threads join in a classic resolution as evil is defeated and mystery is clarified. The characters come alive with conflicts rooted and flowering far beyond the confines of the story. There is satisfaction for the reader. But there is also a slight dis-ease. The alien revolution is *too* timely, and it parallels Earthly events too closely for the reader to accept easily. The ending satisfies in human terms, but not in more cosmic, fateful terms. Too much is destroyed; too much promise is denied.

Am I too vague? You'll have to accept it, for too many of the details are crucial to the book's enjoyment. It is easy to give away too much in this case, and I don't want to spoil it for you. I hope you'll read those details for yourself, so go get a copy. Read it. I think you'll enjoy it.

You can count on Carolyn (C.J.) Cherryh. She writes good stories, full of imagination, action, and understandable, sympathetic characters. You can count on her latest, too. **Downbelow Station** is a fat book: a long one, perhaps even an epic. Certainly it feels as if it were intended to be an epic, and *some people will say it succeeds.* Me, I'm not so sure. The book takes almost its first third to provide the background for the eventual action. And an epic really should move pretty briskly right from the start. Shouldn't it?

Cherryh's world, as usual, is our future. She shows us Earth and its nearer colonies, stations orbiting lifeless worlds and Pell, a second Earth whose settlers live downbelow with the charming natives and supply food to Pell Station and the ships that stop there. She shows us the Beyond, settled by malcontents, ruled by the Union and its vat-bred minions. There is war, and refugees clog Pell Station as Union's forces gather for the final battle with Earth's discredited forces. There is intrigue and treachery and riot, and in the end there is a resolution that leaves Pell the neutral base of the third force in the conflict, the merchanters.

There is plenty of personal conflict here, but the story itself is impersonal, a confrontation of empires. Union is the monolithic, impersonal, controlling State, and it seems clearly the villain. But Earth is equally monolithic, cocooned in bureaucracy (though there are signs of emergence), perhaps equally a villain. The merchanters are the last reservoir of individualism, and the future may belong to them. The heroes are of Pell, though. They are neutral, and largely lost in the shadows of the superpowers. Cherryh's problems with this story may be the same ones any writer would encounter trying to discuss Switzerland's position as a neutral zone between East and West here and now: The story is there, the protagonists are there, but the focus of the story is necessarily displaced to the zones of power, and it suffers.

This problem of focus may be endemic to ambitious novels. It is, in fact, the issue that prompts that classic advice to the beginning writer: Control the size of your story; keep it small enough not to lose your grip on it. Cherryh followed this advice herself in her Faded Sun trilogy, where she confined her focus to a single character and let the larger context develop as the books succeeded each other. Perhaps *Station* would have been better as a trilogy itself, each book taking a different side in the struggle for its focus, or a different period of the story's history.

For all my carping, though, don't let me put you off. Ambition is a killer only for the novice writer. Cherryh is hardly that. For her, ambition is a sign that she

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is not content to write what she has done before, that she struggles to improve her craft, that she strives to grow; and we should welcome that. It bodes well for the future.

For all its problems, in my eyes or yours, *Station is* a good read, and it will hold you for a long weekend. And I *don't* know that I could do better, though I am working on a manuscript now that at least gives me a chance.

In **A Fond Farewell to Dying**, Syd Logsdon has shown us the return of our Golden Age of Science, some time after the bomb-triggered sinking of large parts of the U.S. and Europe. India is the new center, embroiled in a cold war with a Muslim state over ancient lands reclaimed from the sea. Nuclear war threatens again, and under this threat works and lives Ram David Singh, biologist, born David Singer in Ozarka. He devises a way to clone humans and to transfer memories from original to clone. He gets a chance to test the method on the crippled grandson of India's leader. As he clones the cripple, he also clones himself, plants the embryo in his lover's womb, and tapes his memories. A new faction comes to power, the test is stopped, Singh is shot, and his lover feels his soul, his *atman*, enter the fetus within her. Later, Singh's friends around the world—to whom he had sent descriptions of his work—revive it in secrecy, clone his clone, and transcribe his memories so that he lives again.

On one level, *Farewell* is a political-scientific adventure story, and it succeeds fairly well. On another, it considers how the existence of the soul and its transmigration might be proven, given certain technological developments. The book's shift of the science culture to India serves chiefly this purpose, for it provides a mystic context unavailable in Cambridge or Oxford. The book is all the more interesting on this count, for the question it considers is one that must aggravate anyone who believes in or doubts the soul or who is aggravated by the convictions such ideas engender. How much a copy can a clone be? Are souls indivisible or rationed, identity or merely spark? What is the difference between souled and soulless?

Do such questions intrigue you? Then read the book. Logsdon surely doesn't have the last word, but his characters act out his answers realistically, convincingly, and in a solid world. Characters, answers, and world can all be criticized, but they will make you think, and what more can one ask of a literature of ideas?

Grant Carrington's **Time's Fool** is a novel of music and immortality. Garcia is a master of the autar: part sitar, part guitar, part computer. He becomes the darling of the upper class, the jet set, the wealthy industrialists who rule the world, and the lover of one. He is offered a chance to share the immortality they have recently developed, and is inclined to accept. But he is also striving to advance his art, to grow; and finding that taking on a student helps him do that. He learns that risk is essential to art, and when he sees that the new immortals abjure all such chanciness, he makes his decision.

Fool is a moving book. It says something worth saying. It does, however, have problems. Excellence in art may well have its roots in past pain, but when Carrington describes the event that gave Garcia his drive, he makes it sound too simple. Later, too, he gives the complexities of real life short shrift, and his characters thus seem less than three-di-

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mensional.

Far more trivial a problem, yet one that deserves some notice, crops up immediately, right there on Page 1. Carrington writes, "the two friends weaved melodies." I'll grant that "weaved" is legitimate, but my dictionary calls it rare and prefers "wove," which is the word we all use in speech. Is Carrington being cute? Does his vocabulary have a weak spot? Or was the copy editor blind? Whatever, it jars, and it gave me an expectation of more of the same. It was many pages before that anticipation of winces faded and I could enjoy the story for itself. Fortunately, it doesn't happen again, at least not that jarringly.

Frederik Pohl and Frederik Pohl IV (*not* a great-grandson, I presume) have given us **Science Fiction Studies in Film**. They cover the history of SF film from Méliès to Lucas. They don't try to be exhaustive; only to touch the milestones, paying special attention to special effects and financial success. In the process, they offer a pithy distinction between SF and sci-fi: "No sci-fi film (or novel)," they say, "has ever troubled its reader's intellect." SF, on the other hand, does. As a literature (and cinema) of ideas, by definition it provokes thought. Too, SF demands a consistency and logic that is often missing in the best films, and always missing in the worst; they point to *Fantastic Voyage* as a horrible example.

The book is far more valuable than Ed Naha's *Science Fictionary*, damned awhile ago. It is no mere catalog of sketches. It discusses, it puts in context, it relates, it evaluates, it finds meaning. It can be read.

If you like Vincent DiFate's SF illustrations, you will love **DiFate's Catalog of Science Fiction Hardware**. It is a collection of his work loosely disguised as a futuristic scrapbook or photo album, split into sections on transportation, environment, weapons, quality of life, and engineering. Prose by Beth Meacham describes each painting as if it presents reality. Her words are straightforward and usually no more cryptic than the authors whose stories DiFate illustrates.

Is it worth buying? Perhaps not, if you're a fan. You could easily match or beat it by lining up your paperbacks, dust jackets, and back issues of *Analog* along the baseboard. You wouldn't have the descriptive text, but you would have a variety of artists, along with plenty of DiFate. In other words, *Catalog* holds nothing new for you. If you're new to the field, though, fresh to *Analog* from a *Star Wars* turn-on, or if you want to gift such a person, the book is a good buy.

If you know L. Sprague de Camp's work at all, you know what to expect from **The Ragged Edge of Science**, a compendium of articles from the 1950 *Astounding* on to the 1976 *Amra*, with stops along the way in *Science Digest*, the *Philadelphia Sunday Bulletin*, and more. He aims himself at the conclusion-jumpers, frauds, and quacks on the fringe, from Aleister Crowley to von Däniken. He's always readable and entertaining, as he sticks his thumbs into gaping holes of fact and logic, but he is not at all above a certain admiration for the most blatant frauds, out to make a buck whether they believe their own claims or not. He's full of the straight dope (though he often doesn't go into things as deeply as I would like), and it's a real shame that he has not a particle of hope of killing those windmills. Quackery has been, is, and ever will be, no matter how obvious the truth may

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be. The true believers, unfortunately, bitterly resist all efforts to wean them of their addictions.

Do you want to know the truth? Do you want new ammunition for those hopeless party arguments? Or do you want to feel superior to such benighted fools as de Camp and myself? Then buy the book. Whatever your reason, George Scithers will love you.

Duncan Lunan's **New Worlds for Old** is a history of the space age that gives a subjective flavor to a wealth of facts. It emerged from an ASTRA (Association in Scotland To Research into Astronautics) discussion project, an extended series of lectures and discussions that involved numerous experts and concerned amateurs. It is fairly well illustrated with drawings and paintings, but the text does refer to many photos that are not included. This drawback is not serious, however. It irritates, but it does not spoil.

The book is fairly comprehensive. It covers the history of our ideas about the solar system, our most recent discoveries, and the prospects for further work. It urges, in no uncertain terms, that we not stop now; that though the U.S. and NASA seem content to sit on their hands, we must continue. It is, says Lunan, "intended for the level of argument which runs, 'They haven't found anything up there that we didn't expect, and it's all irrelevant anyway.' " It may even have the effect Lunan wants. I hope so. ■

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brass tacks

Dear Mr. Schmidt,

Enough! I have read a number of stories and books, such as Steven E. McDonald's (abysmal, by the way) "Ideologies," in which the perils of "falling" from the axis of a cylindrical space habitat looms in the plot. Some of these have been by people who should have had a good enough grasp of physics to know better.

Someone who drifts off the axis of such a habitat is (surprise, surprise!) in *free fall*. There is no "pseudo-gravity" generated by such a spinning habitat that pulls people toward the rim. To rotate with the habitat requires acceleration (toward the axis!) at the rate presumed. But such a drifter is not rotating with the habitat.

In the absence of air a person would just drift slowly toward the rim and impact with little radial velocity. The danger then would be the angular velocity difference: the rotating rim would swat and/or rip at the person settling down on it. It would be more like jumping from a moving train than falling from a great height.

In the presence of air, motion to the rim occurs only because of viscous drag. "Diving" is impossible. The drag would gradually increase the drifter's circumferential velocity, tending to "throw" outward till the buoyancy due to the air pressure gradient was overcome. This would lead to a gradual, but accelerating, outward spiral. The circumferential velocity gained would mitigate the "swatting" but cause an *apparent* radial acceleration at impact, though the actual radial velocity would not become large.

A person equipped with wings (actually "sculls" might be a more appropriate term) would be able to regain the axis as long as the air drag could be overcome by sculling; no lift is really necessary as there is no gravity to lift against. Upon landing, the velocity difference with the rim constitutes a headwind which makes it possible to stay aloft until it is reduced below the velocity at which the wings can produce 1 G of lift. This is necessarily less than the glide speed. So the landing could be at least as soft as that of a hang glider.

CRAIG SPENCER

Box 113
Eastsound, WA 98245

Dear Mr. Schmidt:

Even though you didn't ask as yet, I thought I'd give you my listing of my 10 favorites in *The Analog Anthology #1*. All stories and articles were good to a lesser or greater degree, but I liked the following the best (not listed by degree, all excellent):

(1) "Twilight" by Don A. Stuart

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(2) "The Chromium Helmet" —Theodore Sturgeon
(3) "The Dread Tomato Addiction"—Mark Clifton
(4) "Transfusion"—Chad Oliver
(5) "The Longest Voyage"—Poul Anderson
(6) "Can These Bones Live?"—Ted Reynolds
(7) "Of Mist, And Grass, And Sand"—Vonda N. McIntyre
(8) "The Lotus Eaters"—Stanley G. Weinbaum
(9) "The Dead Past"—Isaac Asimov
(10) "And He Built a Crooked House"—Robert A. Heinlein

I am anxiously awaiting Vol. #2. The only complaint I have about Vol. #1 is the inclusion of only one female writer (McIntyre). Didn't Leigh Brackett or C.L. Moore write anything for *Astounding*? Stories in more recent years by McCaffrey, LeGuin, Wilhelm, Bradley, etc., would have been welcome also.

JOE AGERKIS

Mountaintop, PA

TO: All Concerned Parties

The Office of Management and Budget has just announced proposed severe cuts in funding for NASA. These cuts would almost eliminate planetary exploration, and would seriously curtail many other NASA programs.

I urge you to contact key people in the Administration and in the Congress, asking for at least level if not increased funding for the United States space effort. Many other space interest organizations are asking their members and boards to do the same.

In particular, you should write the President, OMB Director David Stockman, Senators Schmidt, Packwood, Riegel, Garn, and Hatfield, and Representatives Flippo, Fuqua, Winn, Boland, and your senators and representative. The addresses are:

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U.S. Senate
Washington, D.C. 20510
(for the House)
U.S. House of Representatives
Washington, D.C. 20515

DR. MARK R. CHARTRAND
Executive Director
National Space Institute

Arlington, VA

Dear Mr. Schmidt,

I enjoyed your January editorial, "Cultural Anesthetics." A very clever observation; it made me think of the same anesthetic line all authoritative figures seem to give, "We are here to help you." It's a shame that your message is not reaching as many people as it should. A few copies of your editorial would do much in a communistic nation (or any non-democratic nation, for that matter) if it could be managed to be smuggled into the system. A few undesirable side effects might occur, however. An anarchic government might come into existence as a result, for instance.

I would also like to comment on "Green Winter" written by F. Paul Wilson. It struck me as one of the best short stories that has been printed in *Analog* in a good while. Occasional stories similar to this one would surely raise the already-high standard of *Analog*. "Emergence" and "Expendable" also deserve mention as excellent sto-

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ries.

Analog has certainly begun the year right.

KEVIN B. LANDRENEAU

Sunset, LA

Another favorite line is, "For your convenience" (which invariably means, "For our *convenience"), and still another is, "For your protection" (which may be worth an editorial of its own!).*

Dear Sir,

If any index is to be prepared to *Analog* it must be of key words to locate ideas.

I have just spent two days in a frantic search through my heap of old *Analogs* for an article containing one such idea that was buried in a mass of characterization and irrelevant verbiage. ("Renewal," May 1978.)

Your "In times to come" summaries were too incomplete to be any help and the titles were altogether useless, if not deliberately cryptic.

True SF is the fiction of ideas, and a bizarre or courageous idea can stick in the mind like a bit of meat between one's teeth long after all other associations and the title have gone.

A few way-out ideas I can recall after more than forty years and like to cite them in discussions—but I can never remember where I saw them unless the relevant story is reprinted in an anthology.

Our own Dr. Johnson once said, "Small minds discuss people, average minds discuss events, but great minds discuss ideas."

Has anyone ever tried to classify and catalogue SF ideas?

JOHN C. RUDGE

Harlington, Middlesex, U.K.

Seems to me I have seen a couple of such efforts, but I don't remember where or when. Can anyone out there help?

Dear Sir:

G. Harry Stine's list of six books ("The Most Valuable Books in the World," January *Analog*) is an interesting one, but I doubt the value of any technical books without a good unabridged dictionary to explain technical terms.

The other crucial book is a text on small-scale farming. No food surplus, no civilization. I suggest *The Guide to Self-Sufficiency* by John Seymour, Popular Mechanics Books, New York, N.Y.

PHILIP M. CARABATEAS

Nassau, NY

Gentlemen,

I have to thank you for rekindling my interest in *Analog*. Just a couple of years ago my enthusiasm was on the wane. Since Stanley Schmidt's been editor, I've taken up *Analog* again with renewed confidence. Just a coincidence, maybe; maybe not. In any case I want to comment on what I feel is important to the presentation of *Analog* as a top quality publication: I hope that the change in publisher doesn't accelerate the slide towards commercialism, as evidenced by such nonsense as "classified ads." I realize that some of these changes are needed to create revenue, but gentlemen, please be tasteful. And I *can* tolerate the address label smack on the cover (a cost savings, eh?) until the USPS chews up one of my issues. Then, believe me, you'll hear from me again. Please don't let *Analog* become just another magazine in the publishing rat race. It's at the top of its class now; keep it there.

RICHARD PANNETON

336 Butman Rd
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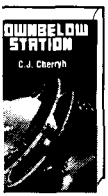

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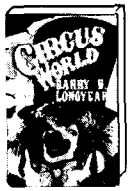

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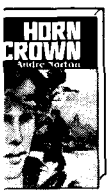

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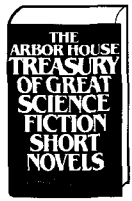

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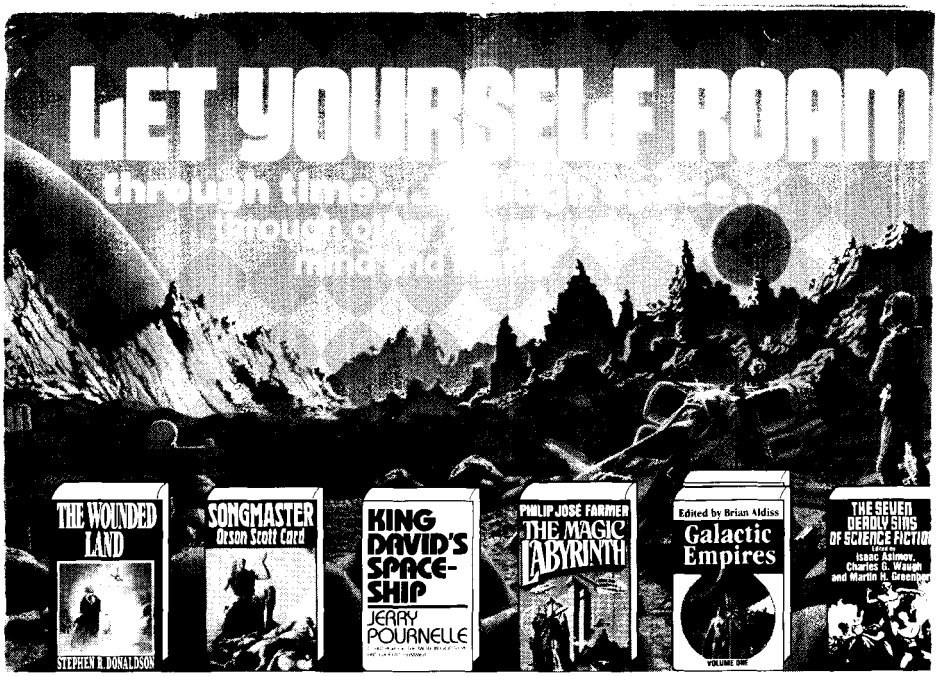

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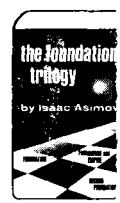

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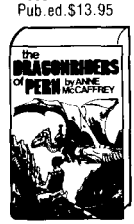

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